



CITY OF MONTROSE

ENGINEERING SPECIFICATIONS

MARCH 2004



CITY OF MONTROSE
Engineering Specifications

Chapter 1 – Introduction – Policies and Procedures for Public Improvement Projects

Chapter 2 – Water Distribution System Standards

Chapter 3 – Sanitary Sewer System Standards

Chapter 4 – Street System Standards

Chapter 5 – Concrete Standards

Chapter 6 – Drainage and Erosion Control Standards

CHAPTER 9-1

INTRODUCTION

POLICIES AND PROCEDURES FOR PUBLIC IMPROVEMENT PROJECTS FOR THE CITY OF MONTROSE, COLORADO

Sections:

- 9-1-1 PURPOSE**
- 9-1-2 DESIGN POLICY**
- 9-1-3 CONSTRUCTION POLICY**
- 9-1-4 GENERAL UTILITY DETAILS**

9-1-1: PURPOSE

The purpose of these Engineering Specifications is to provide minimum standards to safeguard life and limb, health, property and public welfare by regulating the design of, construction of, choice of materials used for, location of, maintenance and use of all public improvements and common facilities. These Engineering Specifications have been prepared to assist Engineers preparing plans for public improvement projects in the City of Montrose (City). These include, but are not limited to, sanitary sewer systems, water supply systems, private utility services lines to water and sewer, public and private storm drainage systems, public and private streets, open space, parks and recreation facilities, traffic signals and devices, public and private parking lots and appurtenances thereto. All equipment and material shall be new unless approved by the City of Montrose.

As used throughout Title 9 of the City of Montrose Regulations Manual, references to “Engineer,” “Project Engineer,” “Design Engineer,” “Developer’s Engineer,” “Engineer of Record,” “Geotechnical Engineer” and “Consulting Engineer” shall each refer to Colorado Registered Professional Engineers.

These Engineering Specifications represent minimum requirements and design values. Additional requirements of higher design values, commensurate with conditions, may be required by the City Engineer if, in his judgment, they are in the best interest of the City. Variations may be permitted based solely on sound engineering practice and will be reviewed and approved by the Department of Public Works on an individual basis. Such variations must be requested in writing along with sufficient documentation supporting the request.

- (A) **Adopted Standards.** All applicable specifications of agencies or organizations listed below are made a portion of these Engineering Specifications by reference and shall be the latest edition or revision thereof. Whenever a conflict exists between any of the above standards, the City Engineer shall decide which shall govern.

A.A.S.H.T.O.	American Association of State Highway and Transportation Officials
A.C.I.	American Concrete Institute
A.D.A	Americans with Disabilities Act regulations
A.I.S.C.	American Institute of Steel Construction
A.N.S.I.	American National Standards Institute
A.P.W.A.	American Public Works Association
A.S.A.	American Standards Association
A.T.S.S.A.	American Traffic Safety Services Association
A.S.M.E.	American Society of Mechanical Engineers
A.S.T.M.	American Society of Testing Materials
A.W.W.A.	American Water Works Association
C.D.P.H.E.	Colorado Department of Public Health and Environment
C.D.O.T.	Colorado Department of Transportation
F.E.M.A.	Federal Emergency Management Agency
F.H.W.A.	Federal Highway Administration
M.U.T.C.D.	Manual on Uniform Traffic Control Devices
I.T.E.	Institute of Traffic Engineers
U.F.C.	Uniform Fire Code

- (B) **Quality Control.** The Contractor is responsible for quality control of all work performed and shall implement whatever procedures, methods, testing, surveying, and supervision required in order to insure that the Work conforms to the Construction Plans and Contract Documents.

- (C) **Quality Assurance.** The entity responsible (e.g. Developer or general contractor) for administering the construction of public facilities shall provide a quality assurance program. This program shall include systematic inspection and testing of the work and materials during construction to assure the Owner and the City that the Contractor is providing work that is in conformance with the City approved plans and specifications.

9-1-2: DESIGN POLICY

- (A) **General.** The City of Montrose shall review and approve the plans and specifications for proposed extensions of, or changes in, street, water, storm, and sanitary sewer systems and to coordinate the approvals of various other City departments and public agencies prior to the beginning of any construction. These design criteria have been compiled to insure that plans and specifications are reviewed and approved on an equal basis, and that uniformity exists in construction of the system.

It is not the intent of these criteria to regulate the design Engineer, but instead, to provide guidelines of minimum design values that should be used in normal situations.

All plans and specifications submitted for checking and approval for construction must have been prepared by or under the direct supervision of an Engineer.

- (B) **Construction Plan Requirements.** All plans submitted to the Community Development Department for review shall conform to the minimum legibility and quality control requirements of this Section. Any drawing submitted for review, which substantially does not meet this specification, will not be accepted for review.

- (1) All grading, erosion control, drainage, utility, and street plans shall conform to the minimum design criteria set forth in these specifications. Two complete sets of plans, on 24" x 36" sheets, shall be supplied to the Public Works Department, through the Community Development Department, for review and comments by the City Engineer. Allow at least three weeks for review and processing. Once the plans have been reviewed, written comments shall be returned to the Community Development Department for correction of plans.
- (2) Construction drawings shall contain the information necessary, presented in a clear and legible manner, to construct the utility. The Engineer shall coordinate the location of all proposed water and/or sanitary sewer lines within all existing and proposed road rights-of-way with regard to existing and proposed roads and drainage structures. In addition, coordination shall be made with other appropriate utility companies and agencies with regard to their existing easements, rights-of-way and facilities.
- (3) Where the possibility of conflicts with existing utilities exists, it shall be the Engineer's responsibility to secure accurate information on the horizontal and vertical location of such utilities through subsurface exploration.

- (C) **Drafting Standards for Paper.** Plans submitted to the Community Development Department shall be direct prints, 24" x 36", by the Diazo or similar process, in blue-line or blackline, on paper equal to the products of the Azon Co. Photocopies or telefacsimile reproductions are not acceptable for plan review, but may be submitted for information or preliminary review purposes.
- (1) All information must be contained within the borders of each sheet, particularly on the plan and profile sheets.
 - (2) No photographs, or prints or reproductions of photographs, shall be a part of any drawing. Specifically, aerial photography may not be used in the plan views or at any other location.
- (D) **Drawings on Electronic Media.** Drawings submitted on electronic media must conform to all the requirements of this Section, and with the following requirements.
- (1) Document must be completely compatible with City of Montrose software.
 - (2) Documents created on compatible software should be received in their standard file formats - for example, AutoCAD documents should be received in .DWG format. The Engineer needs to be aware of discrepancies due to different versions of the software; the Utility Department must be able to work with the media received and send out revisions the Engineer can utilize.
 - (3) All correspondence is to be received in Microsoft Word format or in standard ASCII format.
 - (4) All CAD documents to be received must be in standard AutoDesk – AutoCAD .DWG format. These documents must be free of any third party software restrictions. Restrictions must be purged off the files before sending to the City of Montrose.
- (E) **Construction Drawings.** Construction drawings shall consist of the following: The plan should show sufficient adjacent area to give relation of new facilities to existing facilities. The plans shall be made from actual field surveys referred to land corners and other official survey controls points. Vertical datum for surveys shall be Mean Sea Level (USC & GS Datum). Horizontal control shall be based on New Mexico Meridian Plane Coordinate Grid, South Zone North American Datum of 1983 (NAD 83) by a minimum of two coordinate points. Traverse closure shall be at least 1:5000. Fences shall not be used as the bases of surveys.

- (1) The following shall be shown on each and every page of all drawings:
 - (a) Project Name
 - (b) Owner's name, address, phone number
 - (c) Vicinity Map
 - (d) Index
 - (e) Title Block (right margin of sheet preferred).
 - (f) North Arrow: North shall point to the top or to the left margin of the sheet, other details and drawings on the sheet shall be oriented consistently with the North arrow.
 - (g) Vertical Scale: 1" = 5' (1" = 10' may be used in areas which have average slopes over 5%).
 - (h) Horizontal Scale: minimum, 1" = 50'
 - (i) Date and Revisions: The original date of the plans and any subsequent revisions must be shown in the title block.
 - (j) Name, address, and telephone number of Engineer or firm.
 - (k) Engineer's Seal, Signature and Date.

(F) **Overall Site Plan.** Site Development Plans shall contain the following public improvement facilities, features, and components:

- (1) Sanitary Sewer Plan and Profile
- (2) Water Plan and Profile
- (3) Storm Sewer and/or Surface Drainage Plan and Profile
- (4) Street Plan and Profile
- (5) Traffic Control Plan
- (6) Standard Details when Different from City Engineering Specifications
- (7) Erosion Control Plan
- (8) Property Lines
- (9) Street Names and Easements with all Dimensions Including Lot Dimensions
- (10) Existing Utilities and Structures

(G) **Field Control.** It is the responsibility of the developer or his representative to survey the proposed installation and set control stakes in accordance with approved plans. Construction of lines will not continue and installations will not be approved where in the opinion of the City Engineer, proper control has not been furnished. The contractor shall be responsible for preserving all permanent bench marks and survey monuments.

(H) **Easement.** All public utilities shall be in an easement with a width of at least two times the depth to the invert. In a subdivision where the rear lot line abuts property outside of the subdivision on which there are not easements at least 5 feet in width then the easement or alley on the rear lot lines in the subdivision shall be at least 20 feet in width.

9-1-3: CONSTRUCTION POLICY

- (A) **Engineered and Approved Plans.** Construction shall be done in accordance with engineered construction plans approved by the City, for the work prepared under the direction of a Colorado Registered Professional Engineer. Plans shall conform to the City of Montrose minimum design standards. Plans approved by the City are valid for a period of one year, after which the plans will require a cursory review to verify conformance to current City requirements. Construction of public improvements shall not begin without approved construction plans and a written notice to proceed from the City Engineer.
- (B) **Inspection and Testing.** All construction work for public improvement projects shall be subject to inspection by the City Engineer and certain types of construction shall have continuous inspection.
- (1) It shall be the responsibility of the person performing the work to notify the City Engineer that such work is ready for inspection. The City Engineer shall require that every request for inspection be filed at least forty-eight (48) hours before such inspection is desired. Such request may be in writing or by telephone, at the option of the City Engineer.
 - (2) It shall be the responsibility of the person requesting inspections required by these Engineering Specifications to provide access to and means for proper inspection of all work. The contractor shall meet with the City Engineer or his authorized representative on location for said final inspection. Final inspection shall not take place until street or easement is at final grade and all manholes, valve cover, etc., are brought to final grade.
 - (3) A City Representative who shall have the authority to halt construction when these specifications or standard construction practices are not being adhered to shall inspect all work, including correction work. Whenever any portion of these specifications is violated, the City may order further construction to cease until all deficiencies are corrected. The notice to cease construction shall be in writing (Stop Work Order). If deficiencies are not corrected, performance shall be required of the contractor's surety.
 - (4) The City Engineer may make or require additional inspections of any work as deemed necessary to ascertain compliance with the provisions of these Engineering Specifications and other provisions of the City Code.
- (C) **Utility Construction Procedures.** One-week prior to commencement of construction, the contractor shall arrange a conference with the City Engineer for the following:

18-Mar-04

- (1) To become familiar with the City of Montrose Engineering Specifications.
- (2) 48 hours prior to obtaining a construction permit, the contractor shall call the office of City Engineer and arrange a pre-construction meeting.
- (3) The contractor shall call the office of the City Engineer for any required inspections including witnessing of required tests at least 48 hours in advance of inspection.

(D) **As Built Information.** It is the duty of the Responsible Party to record and document the physical dimensions and any changes on a set of as-built drawings and to certify as to their accuracy. A PLS or PE shall document the following information to certify the construction plans as being constructed as-built.

- (1) Streets:
 - (a) Elevation check at a maximum one hundred fifty (150) foot intervals in each flow line along street, at the point of curb return of each radii, and at the center of each cross pan.
 - (b) Elevation at flowline at each side of storm inlets (inverts).
 - (c) Elevations at all points shown on the cul-de-sac detail, and at the center and high points in the flowline.
- (2) Sanitary and Storm Sewers:
 - (a) Elevation of inverts at manholes, inlets, and outlets.
 - (b) Pipe diameter, material type, length, and stationing from manholes. All sanitary sewer service connection location information is to be supplied by Contractor to the Responsible Party.
 - (c) Rim elevations on all manholes and drainage inlet structures.
 - (d) Final detention pond volume from cross sections and the final release rates per drainage criteria (PE certification only).
- (3) Water Mains:
 - (a) Horizontal verification of water valves, fire hydrants, and type of material.
 - (b) The locations of all service connections along the main are to be supplied by Contractor to the Responsible Party.
 - (c) As-builts may be field verified by the City and shall be approved by the City prior to initial acceptance by the City.

- (E) **Submittal of As-Built Plans and Documents.** Final “As-Built” plans shall be Mylar, clear and clean from objectionable background. Once approved by the City, the land surveyor, Engineer, or architect shall submit one (1) complete set of full size Mylar plans as stated in Subsection (D) above. Electronic files shall be submitted to the City of Montrose, Community Development Department.

9-1-4: GENERAL UTILITY DETAILS

GU-01 Utility Plan for Streets

GU-02 Street Cross Section

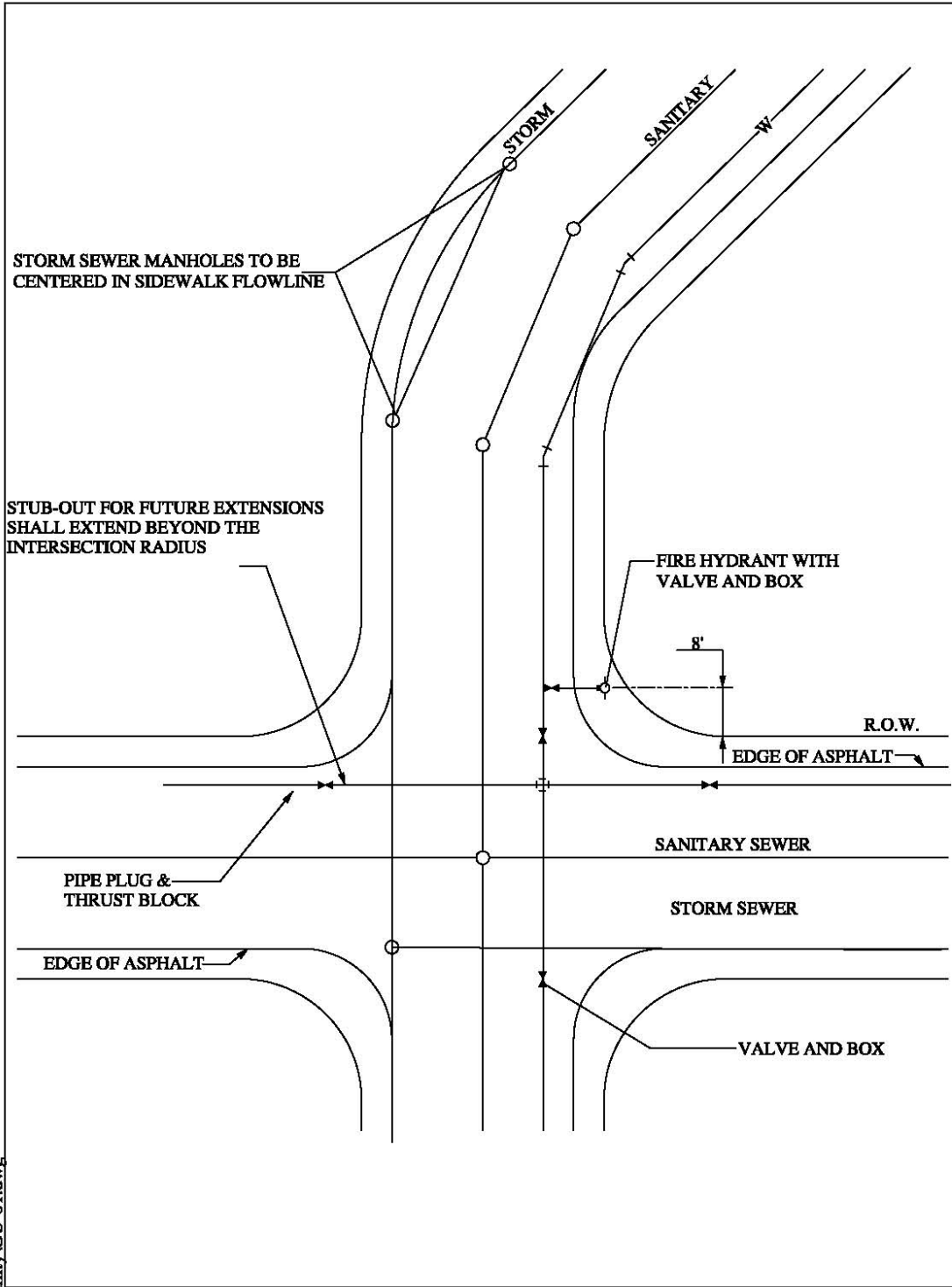
GU-03 Trench Detail

GU-04 Water and Sewer Line Crossings

GU-05 Curb Stamp for Sewer Service Location

GU-06 Standard Pipe Casing / Non-Restrained Joints

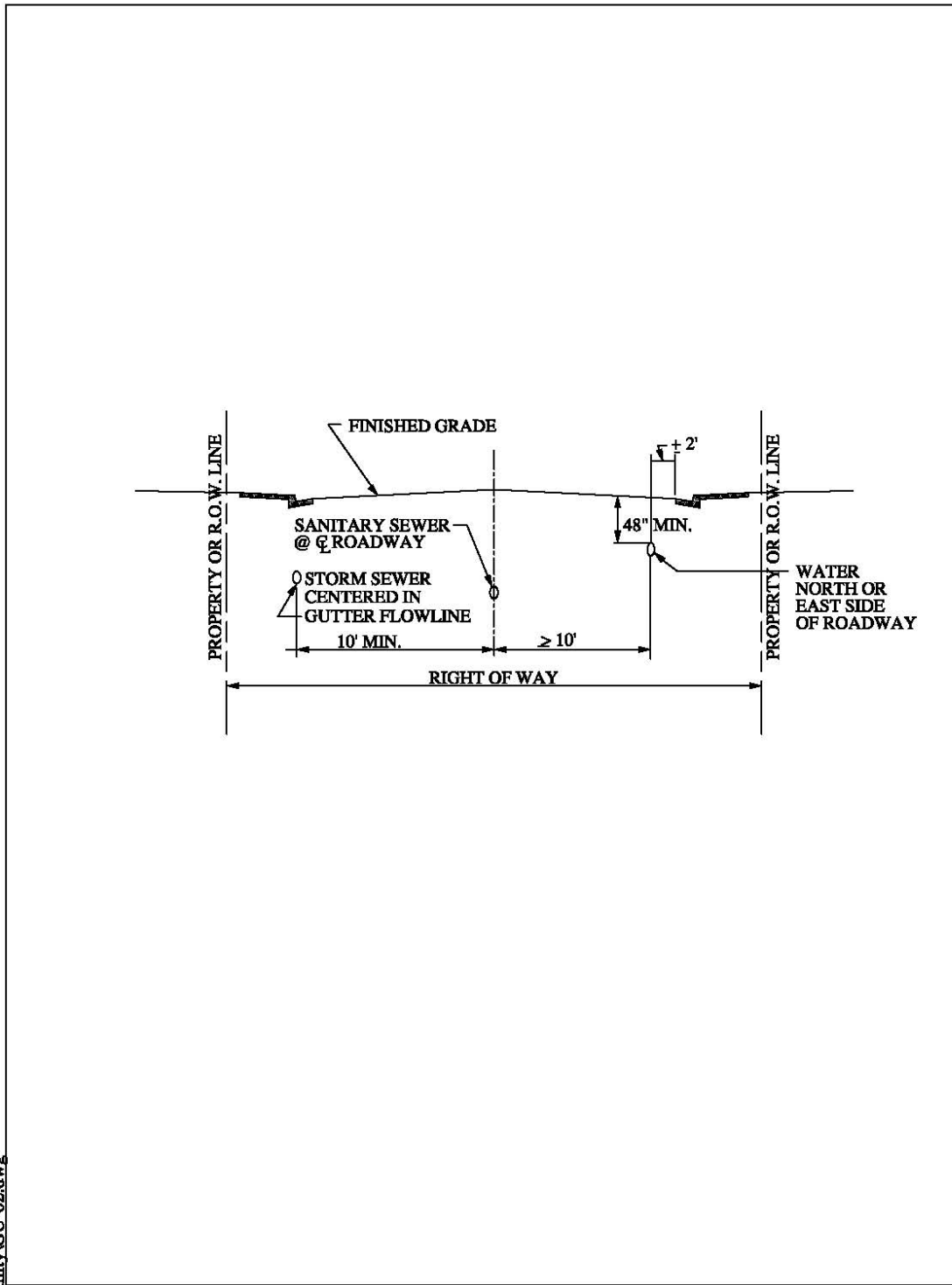
GU-07 Standard Pipe Casing / Restrained Joint



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TYPICAL UTILITY PLAN FOR STREETS

 <p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT</p>	<p>STANDARD GENERAL UTILITY DETAILS</p>	<p>APPROVED: <u>L.R.</u> REV: <u>JULY 2003</u> DRAWN BY: <u>L.R.</u></p>	<p>PAGE GU-01</p>
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TYPICAL STREET CROSS SECTION

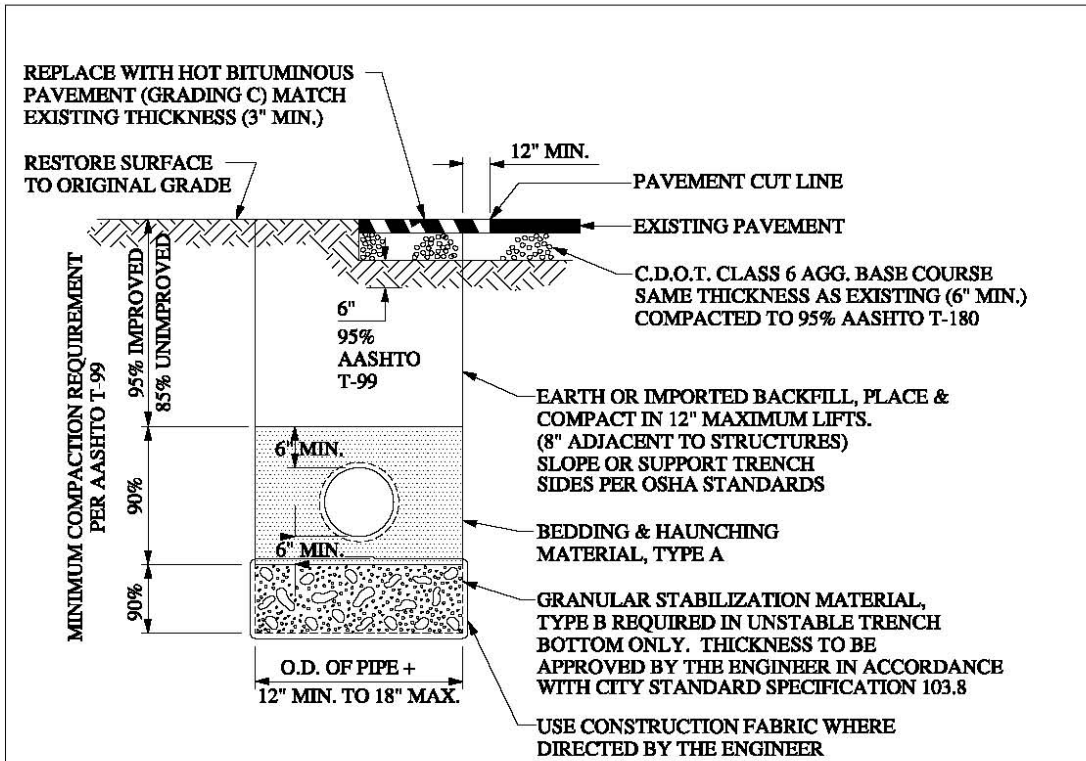


PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION
QUALITY OF LIFE IS OUR COMMITMENT

STANDARD GENERAL
UTILITY DETAILS

APPROVED: SLR
REV: JULY 2003
DRAWN BY: SLR

PAGE
GU-02



SIEVE SIZE	MAXIMUM PERCENT BY WEIGHT PASSING SQUARE MESH SIEVES		
	PIPE BEDDING & HAUNCHING MATERIAL (TYPE A)	GRANULAR STABILIZATION MATERIAL (SCREENED OR CRUSHED ROCK TYPE B)	IMPORTED MATERIAL (TO BE USED WHERE SPECIFIED OR DIRECTED BY THE ENGINEER)
12 INCH	---	---	100
2 INCH	---	100	---
1 INCH	100	---	---
NO 4	---	15 MAX	---
NO 200	20 MAX	---	3% - 20%

IMPORTED MATERIAL SHALL HAVE A MAXIMUM PLASTICITY INDEX (PI) OF 7.

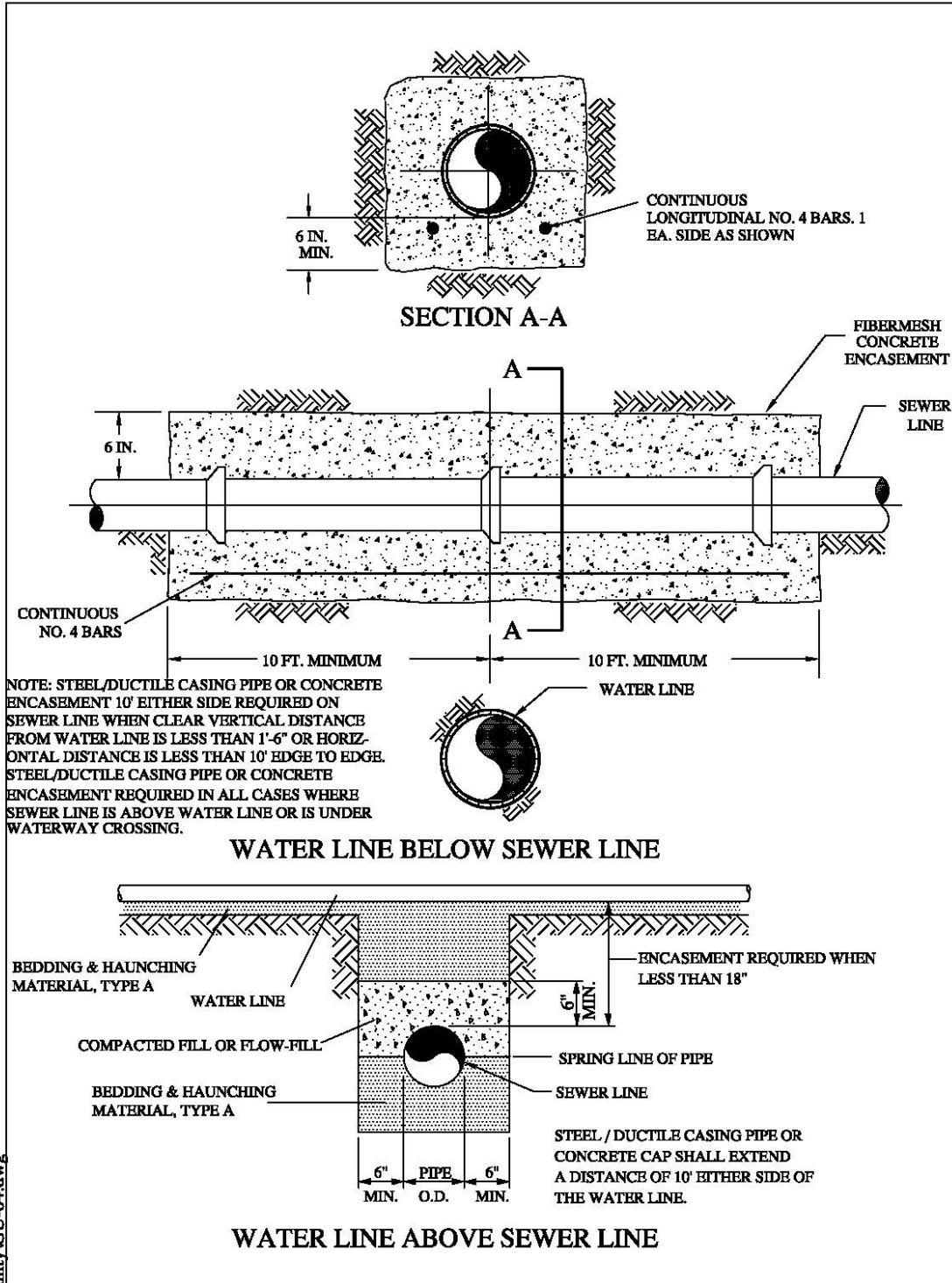
ALL BACKFILL MATERIAL SHALL BE PLACED FULL WIDTH IN 12" MAX. LIFTS (8" LIFTS ADJACENT TO STRUCTURES) AND COMPACTED TO THE MIN. RELATIVE DENSITIES SHOWN.

NOTE: NATIVE MATERIAL MAY BE USED IN LIEU OF GRANULAR BEDDING & HAUNCHING MATERIAL IF APPROVED BY THE ENGINEER AND THE NATIVE MATERIAL IS IN COMPLIANCE WITH SIZE REQUIREMENTS FOR "TYPE A".

TYPICAL TRENCH DETAIL

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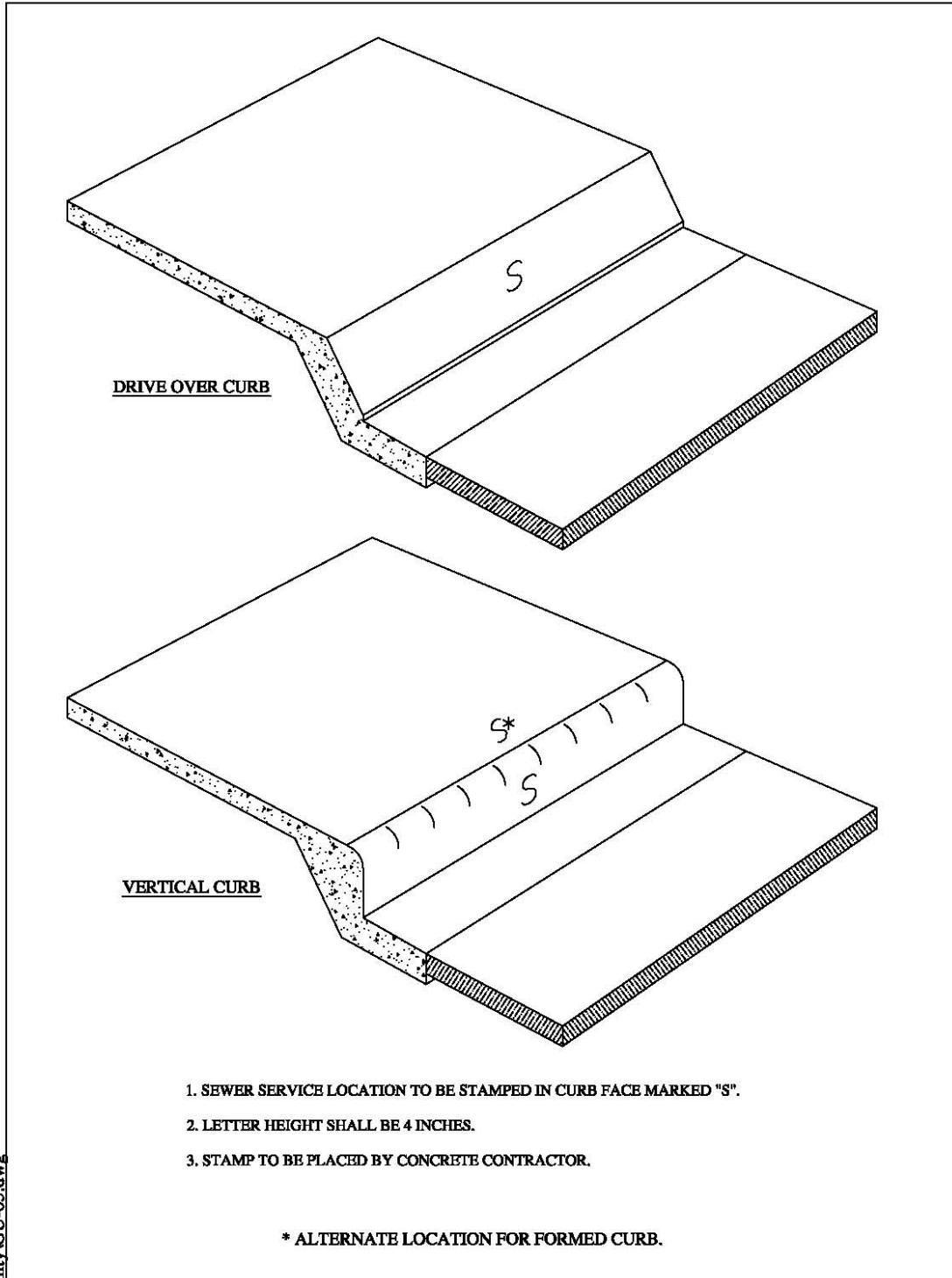
<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION</p> <p>QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD GENERAL UTILITY DETAILS</p>	APPROVED: <u>LAR</u>	<p>PAGE GU-03</p>
			<p>REV: <u>JULY 2003</u></p> <p>DRAWN BY: <u>CLR</u></p>	



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TYPICAL WATER AND SEWER LINE CROSSINGS

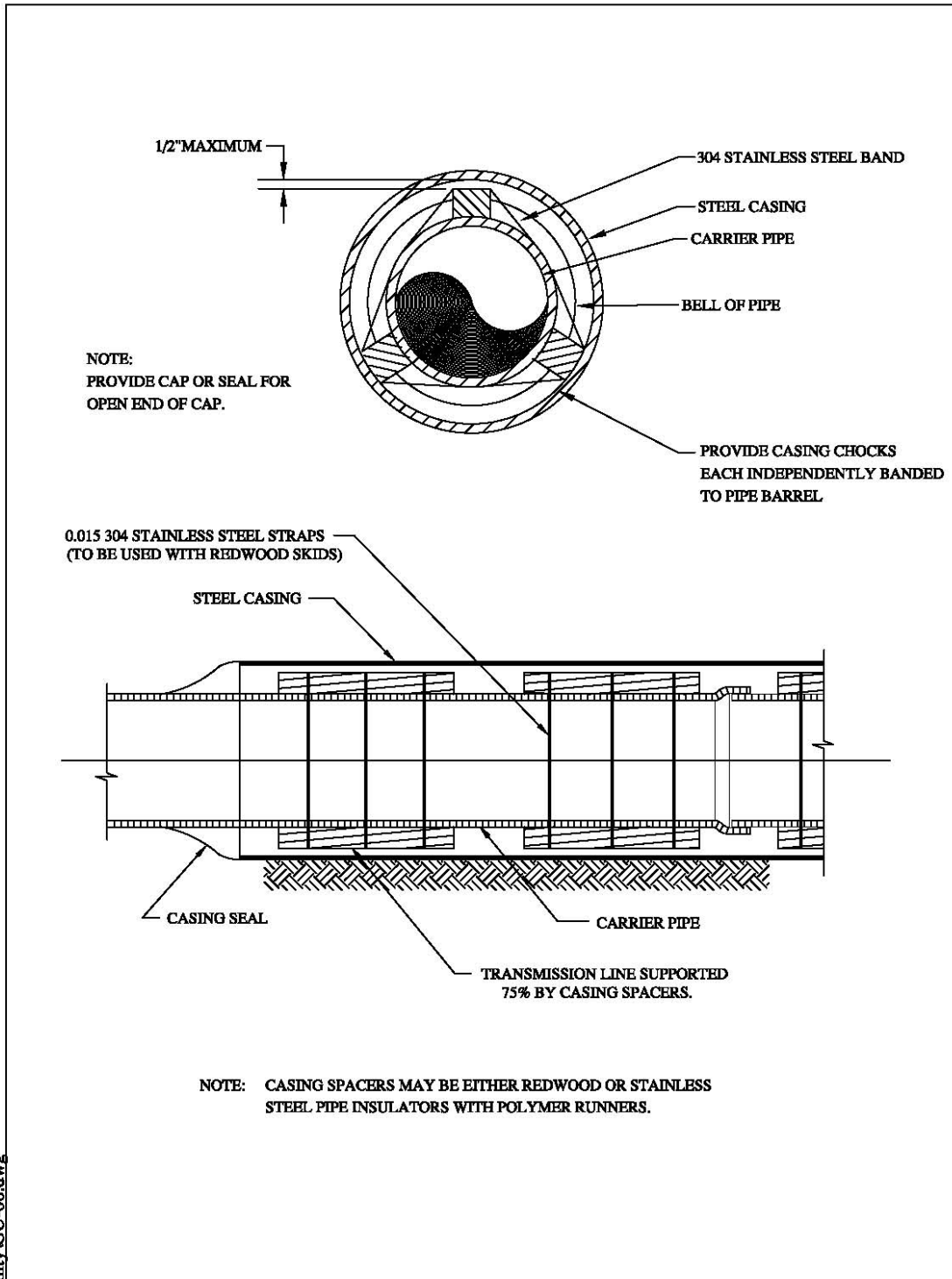
<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION</p> <p>QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD GENERAL UTILITY DETAILS</p>	<p>APPROVED: <u>SLR</u></p> <p>REV: <u>JULY 2003</u></p> <p>DRAWN BY: <u>SLR</u></p>	<p>PAGE GU-04</p>
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SIDEWALK MARKINGS

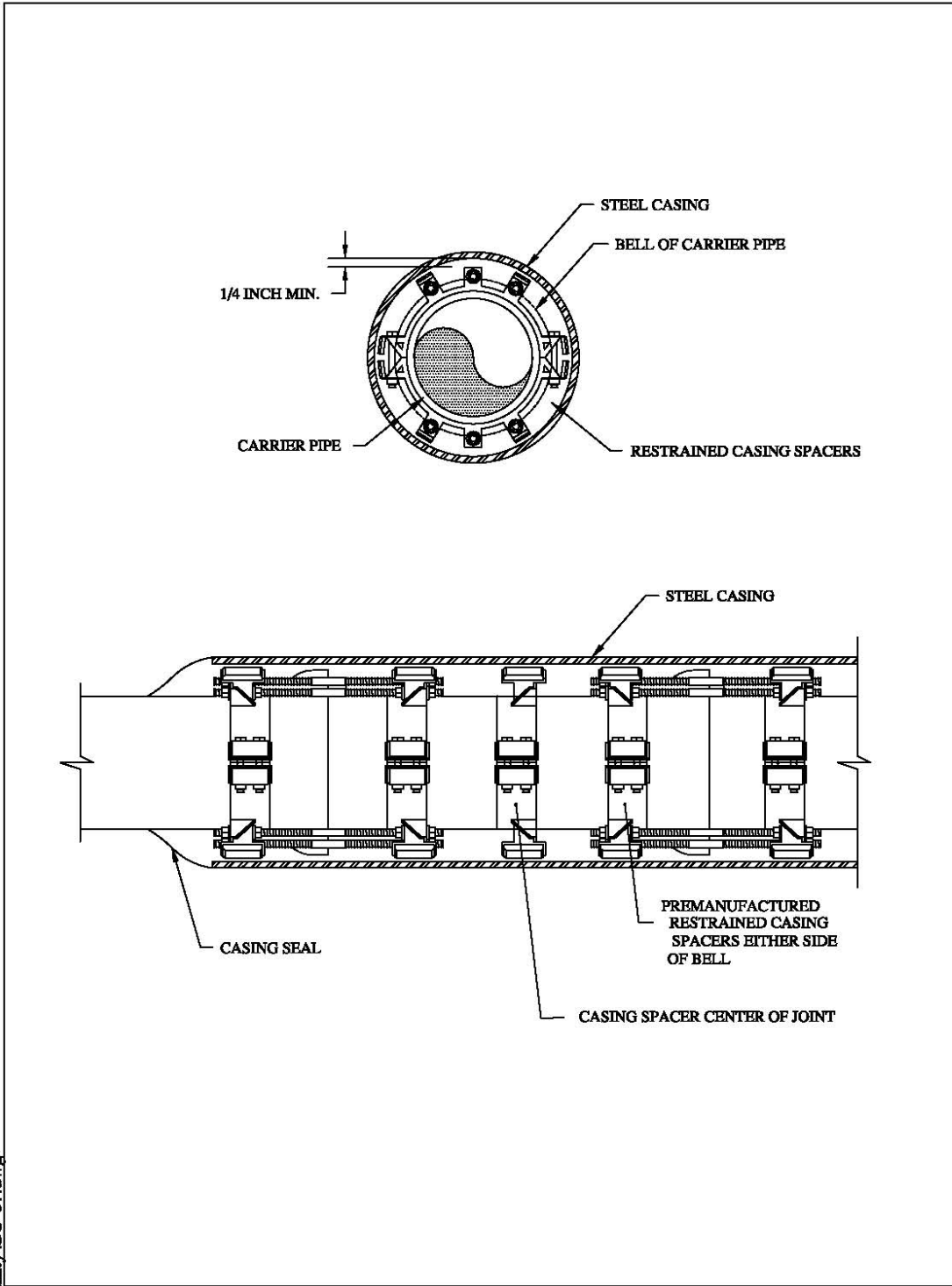
 CITY OF MONTROSE	PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!	STANDARD GENERAL UTILITY DETAILS	APPROVED: <u>LAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>CLR</u>	PAGE GU-05
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STANDARD PIPE CASING / NON-RESTRAINED JOINTS

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STANDARD PIPE CASING / RESTRAINED JOINTS

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CHAPTER 9-2

WATER DISTRIBUTION SYSTEM STANDARDS

Sections:

- 9-2-1: GENERAL PROVISIONS
- 9-2-2: WATER DISTRIBUTION SYSTEM DESIGN CRITERIA
- 9-2-3: WATER DISTRIBUTION SYSTEM CONSTRUCTION SPECIFICATIONS
- 9-2-4: WATER LINE APPURTENANCE SPECIFICATIONS
- 9-2-5: REMOVALS, EXCAVATION, BACKFILLING, AND RESTORATION SPECIFICATIONS
- 9-2-6: PIPELINE TESTING
- 9-2-7: DISINFECTION OF WATER LINES
- 9-2-8: FINAL INSPECTION AND ACCEPTANCE
- 9-2-9: WATER SYSTEM DETAILS

9-2-1: GENERAL PROVISIONS

- (A) **General.** An Engineer shall design public water mains. Designs shall be in accordance with the Latest Edition of Colorado's Primary Drinking Water and Water Design Regulations. It is the responsibility of the Consulting Engineer to inform developers of the contents as set forth in the applicable local ordinances as it relates to the project under review and consideration by the Public Works Department.
- (B) **Future Extensions.** It should be noted that where it is determined that water lines are necessary to serve property beyond the subdivision or development in question, the developer will be required to design and construct his system, properly sized and at an appropriate location, to permit future extensions to be made at the limits of the subdivision or development in question. The system must terminate, at all points in new development, to within one lot from the adjacent and/or upstream properties to be served by the system in the future. Public water systems must be designed and constructed along major roads and/or through the development to facilitate for future extensions. In selecting routes for water extensions, the Department of Public Works requires that the location must be such that it maximizes the potential for serving areas and/or future developments.

- (C) **Quality Control and Quality Assurance.** Quality Control testing shall be in accordance with Section 9-1-1 (B). Quality Assurance shall be in accordance with Section 9-1-1 (C) and Table 1 below.

(1) Table 1 – Required Quality Assurance Testing

TEST REQUIRED	TEST PROCEDURE	REQUIRED OR ALLOWED RANGE	MINIMUM TEST FREQUENCY
Compaction of bedding and haunching materials (except crushed rock)	AASHTO T 99 And T 265	90% minimum see notes	1 per 400 L.F. of trench (and each branch or section of trench less than 400 feet in length) for each two-foot vertical depth of backfill material.
Trench Compaction to subgrade 1. Within right of way. 2. In unimproved areas outside of right of way or within landscaped areas.	AASHTO T 180 And T 265	95% minimum see notes Match existing or 85% minimum	
Compaction of aggregate base course material	AASHTO T 180 And T 265	95% minimum see notes	1 per 200 S.Y.
Compaction within 24" of all structures (manholes, catch basins, vaults, etc.)	AASHTO T 180 And T 265	95% minimum see notes	1 per each two-foot vertical depth of backfill material or per 100 L.F. of structure perimeter

Notes:

Compaction of Clay soils – Compaction requirements per test procedure at optimum moisture to + 4%

Compaction of Non clay soils – Compaction requirements per test procedure near optimum moisture +/- 2%

- (D) Materials: All materials used shall be new and in conformance with the applicable standards.
- (1) **Contractor Requirements.** All materials to be furnished by the Contractor shall conform to the requirements of these specifications. The type, size and strength class of pipe, fittings and other materials shall be as shown on the Construction Drawings.
 - (2) **City Furnished Materials.** When the City furnishes materials that are to be incorporated into the Work by the Contractor, provisions will be made in the Special Conditions as to the responsibilities of the City and the Contractor regarding delivery, unloading and storage of the materials.
 - (3) **Inspection and Testing.** All pipe shall be tested in conformance with the applicable standards. Testing may be witnessed by the Engineer's representative, or by an approved independent testing laboratory. Upon request of the Engineer, the Contractor shall provide a copy of certified test reports indicating that material does conform to the applicable standards or specifications.
 - (4) **Handling.** All materials shall be handled with equipment and methods adequate to prevent shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground. If any part of the coating or lining is damaged, the Contractor shall repair or replace the material at his expense as directed by the Engineer. All pipe and appurtenances shall be handled in accordance with the appropriate AWWA and ASTM standards.
 - (5) **Storage.** The Contractor will be held responsible for the safe storage and protection of all pipe and other materials delivered to the work site. The interiors of all pipe and fittings shall be kept free from dirt and foreign matter at all times. Gaskets for pipe joints shall be stored in a cool location out of direct sunlight. If sunburned pipe is utilized, the City requires that the contractor provide a manufacturer's certification that all warranties are still valid. The City reserves the right to reject sunburned pipe depending on the severity of the apparent damage. Any material that has been damaged before actual incorporation in the Work shall be repaired or replaced at the Contractor's expense.

9-2-2: WATER DISTRIBUTION SYSTEM DESIGN CRITERIA

- (A) **Water Line Location.** Generally, water lines to be installed in proposed subdivisions and local streets shall be located 2 feet north or east off the edge of pavement where there is no curb and gutter and 4 feet in front of the face of curb north or east (pavement side) where there is curb and gutter. However, within proposed curb and gutter streets, an alternate design should be considered if right-of-way is available and a design is feasible. Water lines to be installed along existing roads will generally be installed in easements where the road is likely to be widened in the future and in the right of way where the road will not be widened in the future.

Where water lines are to be installed in roads expected to be widened in the future, they shall be located in easements unless the future road cross section is known and location of water line is designed to avoid future relocation. Water lines shall be designed so that changes in alignment are made with bends with approved thrust blocks or approved mechanical joint restraint systems wherever applicable. All mechanical joint thrust restraint system calculations to be shown on plans with a detail sketch showing length of pipe and fittings to be restrained. The Engineer shall verify existing field conditions to develop soil classifications for calculated bearing pressures.

- (1) **Within Subdivision Easements:** In subdivisions, water mains will be permitted in easements only when there is no other feasible alternative and prior approval is obtained from the Public Works Department. Easements shall be at least two times the depth of the utility being installed or a minimum of 20 feet wide.
- (2) **Existing Systems and Structures:** The Engineer shall consider the location of existing and proposed sanitary sewer and storm drainage systems and all other underground structures and utilities that could affect the location and type of materials for the pipeline. The selected location should avoid conflicts and facilitate future maintenance. Where the possibility of conflicts with existing utilities and/or other structures exists, it shall be the Engineer's responsibility to secure accurate information on the exact horizontal and vertical location of such utilities through subsurface exploration and reflect this exact information on the plans.
- (3) **Separation Standards:** The Engineer shall consider the requirement for separation of water and sanitary sewer facilities and shall use the same requirements stated in section 9-3-2 (B), Sanitary Sewer Location, of these standards.

(B) **Water Line Depth.** Minimum cover shall be 48 inches. All water lines shall be constructed to a depth that will provide protection against freezing and thawing, insure adequate cover over valves and other appurtenances and provide service accessibility. New installation of water lines adjacent to roadways shall have a minimum of 48 inches of cover from existing/proposed edge of pavement. Greater depths shall be required where street grades will possibly be lowered in the future. Clearance shall be provided for enlargement of undersized drainage structures. Any development, which takes place over an existing water main, shall be required to maintain the water main at a maximum depth of 10' below finished grade. Where the depth exceeds 10' the water main shall be raised to the standard minimum depth of 48". Valves, manholes, air relief valves, fire hydrants, service lines and other appurtenances shall be constructed in accordance with City of Montrose Standard Specifications for Construction of Underground Utilities and Standard Waterline Details.

(C) **Water Line Appurtenances.**

- (1) Fire Hydrants. Hydrants in residential areas should be located at corners or in mid-block at lot lines as approved by the Montrose Fire Protection District. Maximum hydrant spacing shall be 500 feet and no more than 250 feet to any house. When cul-de-sacs are longer than 250', the last fire hydrant shall be designed immediately before the bulb of the cul-de-sac, where practical. The developer is to make the necessary improvements to the system to satisfy fire flow demands as determined and required by the Montrose Fire Protection District.
- (2) Valves. Valves shall be located at not over 400 foot intervals and at all changes in pipe diameter. Valves shall also be provided at all pipe line intersections so as to provide shut off for repairs of limited sections without interruption of service to large areas and to facilitate testing. A minimum of two valves shall be provided at tees, three valves at crosses. All Valves are to be restrained to fittings by approved method.
- (3) Tees and Tapping Sleeves. When connecting to an existing water main, installing a tee as opposed to a tapping sleeve and valve is especially desirable when there are long distances between main line valves (greater than 1,000 feet) or even if the distance is less than 1,000 feet where it would be an advantage to add a main line valve for better system control. Therefore, it is important that each project be carefully evaluated by the developer's Engineer with the City Engineer's assistance to determine if a main line valve is needed and/or cutting in a tee is practical, taking into consideration how many residences, businesses, hospitals, etc. may be without water.

- (D) **Structural Design.** Structural requirements must be considered in the design of all water mains and appurtenances. This is a matter of detail design and is not subject to simple generalization. The Design Engineer should consider the following criteria:
- (1) **Special Structures.** Structures shall be built as shown in the standard details. However, structures other than those shown in the standard details shall be considered special structures and shall be designed and detailed by the Design Engineer and submitted for review and approval to the City Engineer prior to plan submittal or brought to the Department's attention at the time of plan submittal.
 - (2) **Pipe Foundation.** In all cases the proper strength water pipe shall be specified for the proposed depth, width of trench and bedding condition. Soil condition should be considered with samples being obtained where necessary to verify pipe selection and foundation design.
 - (3) **Thrust Protection.** Thrust protection as shown on plans in the standard details shall consist of concrete thrust blocks against undisturbed earth. Approved mechanical joint restraint systems may be required for ductile iron and PVC C-900 pipe. Hydrant valves shall be installed with hydrant tees and hydrant protected from thrust by approved mechanical joint restraints and concrete thrust blocks.
 - (4) **Mechanical Restraints.** Where valves are placed for future water line extensions, valves are to be rodded to the fitting and a minimum 20' length of pipe shall be installed past the valve except where calculations or local conditions indicate more pipe is required to provide adequate restraint. Dead-end lines shall be provided with a fire hydrant. Approved mechanical joint restraint systems are to be used as required to provide adequate retention of the pipe and valve when thrust blocks cannot be used.
- (E) **Water Line Hydraulic Design.** Water distribution systems shall be designed to provide adequate flow and pressure for both domestic supply and fire flow based on sound hydraulic analysis. Design shall be based on a maximum flow velocity at peak flows (excluding fire flow) of 5 feet per second and a Hazen-Williams "C" Value of 150. The water distribution system and any extensions thereto shall be designed to supply the demands of all customers while maintaining 35 psi at maximum day plus fire flow or peak hour domestic, whichever is greater. Design of the water system shall generally be such as to maintain 40 psi at maximum day demand. When 40 psi cannot be maintained, the Engineer shall be responsible for coordinating with the City Engineer to investigate alternatives in order to provide 40 psi. Designs providing less than 40 psi will be evaluated on an individual basis. Also, the design of the water line should be such that a velocity of 2.5 fps. can be maintained at blow off devices (flushing hydrants) and at hydrants for proper flushing.

(1) The following criteria shall be used in estimating average daily demands:

Discharge Facility	Gallons per day per acre	Equivalent Persons/Acre
Residential		
Low Density (1.0-3.0 dwellings per acre)	500	5
Medium Density (3.1-7.0 dwelling units per acre)	1,000	10
High Density (7.1+ dwelling units per acre)	2,500	25
Other		
Agriculture/Undeveloped Land	1,000	10
Commercial		
Business	2,000	20
Regional/Commercial	2,500	25
Industrial		
Light	2,500	25
General	3,500	35

(2) Where site-specific determinations can be made, flows may be determined by using the following design information:

Discharge Facility	Design Units	Flow gpd
Residential Units		
a) Single Family Units Includes Townhouses, Individual House Trailers	3.5 people/dwelling	350
(b) Apartments and Condominiums	4 people/3 bedroom apt	350
	3 people/2 bedroom apt	300
	2 people/1 bedroom apt	200
Schools with showers and cafeteria Elementary High School	Per person	16
	Per person	25
Motels and Hotels –rooms only	Per person	130
Restaurants	Per seat	50
Service Stations	Per vehicle serviced	10
Factories	Per person/8 hr shift	25

Discharge Facility	Design Units	Flow gpd
Shopping Centers	Per 1000 sq ft of Ultimate Floor space	250
Hospitals	Per bed	300
Nursing Homes	Per bed	200
Homes for the Aged	Per bed	100
Doctors Office in Medical Center	Per 1000 sq ft	500
Laundromats, 9 to 12 machines	Per machine	500
Theaters, Auditorium Type	Per seat	5
Bowling Alleys	Per lane	75
Office Buildings	1000 sq ft ultimate floor space	200

- (3) To determine maximum daily demands and peak hourly demands the following multipliers shall be used:

$$\begin{aligned} \text{Maximum Daily Demand} &= 1.8 \text{ times Average Daily Demand} \\ \text{Peak Hourly Demand} &= 2.36 \text{ times Average Daily Demand} \end{aligned}$$

- (4) Fire flow requirements for non-residential areas shall be in accordance with the National Fire Protection Association Handbook (latest revisions) and the applicable sections of UBC, and shall be coordinated with the Montrose Fire Protection District.
- (5) Minimum pipe size shall be 8", except that terminal water lines will be six (6) inches in diameter unless a larger diameter line is needed to meet the peak domestic demand and/or fire flow requirements. Water extensions shall be designed to make continuous loops, connecting to the City water system in at least two points to provide alternate sources of supply.
- (6) Services and meters shall be sized and locations designed in accordance with the Standard Details. Minimum service size shall be 3/4" pipe with 5/8" meter. Services shall be designed and reflected on the plans for both residential and commercial developments.
- (7) Pressure reducing valves (PRV) shall be installed on the customer side of the meter by the builder or property owner, the PRV shall be operated and maintained by the customer when the service connection system pressure will be greater than 80 psi.
- (8) Blow offs shall be provided at low points on mains 16-inches and larger. For 12-inch mains, blow offs shall be provided at creek crossings.

- (9) Engineer should use the following guidelines, in regard to location of flush points, air release valves, blow offs, looping etc. during the design of public water systems:
- (a) Minimize the number of blow offs, and strategically place them so that proper flushing can be performed.
 - (b) Minimizing number of air release valves, taking into consideration the depth that the water line is to be placed.
 - (c) Water main extensions shall be designed to make continuous loops. Two supply points shall be provided for alternate source of supply.
- (F) **Railroad Crossings.** All water line crossings of railroads and, where required, roadways, and other major structures shall be encased in a carrier pipe. Design of railroad crossings shall comply with the requirements of Union Pacific Railroad, Utilities Installation Procedures.
- (G) **Stream Crossings.** Water mains entering or crossing streams shall be Ductile Iron Pipe (minimum Class 52). The tops of these mains shall be a sufficient depth below the natural bottom of the streambed to protect the pipe. In general, 3.5 feet of suitable cover is required. The pipe and joints shall be designed, constructed, and protected against anticipated hydraulic and physical, longitudinal, vertical, horizontal loads, erosion and impact.
- (1) Water mains constructed on piers will be permitted only when it can be demonstrated that no other practical alternative exists. The Engineer shall submit a design for the piers, pier foundation and pipe that will demonstrate the structural integrity of the proposed system.
 - (2) Above ground pipe shall be adequately supported, protected from damage from freezing, accessible for repair or replacement and above the 100-year flood elevation.
 - (3) Sub aqueous water main installations will be permitted only when it can be demonstrated that no other practical alternative exists. The pipe shall be of special construction having flexible watertight joints. Special attention shall be directed to foundation conditions for the pipe and to thrust resistance.
 - (4) For both the above ground and subaqueous crossings the design shall provide valves at both ends of the crossing so that the section can be isolated for tests and repairs. The valves shall be easily accessible and not subject to flooding.

- (H) **Pipe and Fittings for Water Mains and Service Connections.** Pipe for water mains 12" in diameter and smaller shall be Polyvinyl Chloride (PVC) unless otherwise approved. Water mains larger than 12" in diameter shall be PVC or ductile iron unless otherwise approved.
- (1) Ductile Iron Pipe. Ductile iron pipe for water mains shall conform to AWWA C-151, pressure-class to be determined in accordance with AWWA C-150. Ductile iron pipe shall be cement-mortar lined in accordance with AWWA C-104. Although minimal cracking in the cement lining is allowed, the absence of cement mortar lining in any part of the pipe shall be reason for rejection.
 - (a) Joints. Unless otherwise specified in the *Construction Drawings* or Special Provisions, ductile iron pipe joints shall be mechanical or push-on joints conforming to AWWA C-111. Gaskets shall be of neoprene or other synthetic rubber material.
 - (b) Fittings. Fittings for ductile iron pipe shall be in accordance with AWWA C-153 and shall have a pressure rating of not less than that specified for the pipe. Fittings shall be ductile iron and shall be cement-mortar lined per AWWA C-104. Although minimal cracking in the cement lining is allowed, the absence of cement mortar lining in any part of the fitting shall be reason for rejection.
 - (c) Bolts. All bolts for mechanical joints shall be Cor-Blue® bolts or approved equal. All bolts for flange connections shall be stainless steel bolts with the threads coated with anti-seize.
 - (d) Polyethylene Encasement. Polyethylene encasement material for the encasing of ductile iron pipe and fittings shall conform to AWWA C-105.
 - (2) PVC Water Distribution Pipe. PVC pipe and fittings for the City's water distribution system shall conform to AWWA C-900 for sizes 4" through 12" and to AWWA C-905 for sizes 14" through 36". Unless otherwise specified, the minimum thickness class of C-900 PVC pipe shall a Dimension Ratio (DR) of 18. Minimum thickness class of C-905 PVC is DR25.
 - (a) Joints. Joints shall be bell and spigot type sealed with elastomeric gaskets conforming to ASTM D-3139. Couplings shall be able to withstand the same internal pressure and external loading as the pipe.

- (b) Fittings. PVC fittings for C-900 PVC pipe will not be allowed. Ductile iron and cast iron fittings for use on PVC pipe shall conform to subsection 9-2-2 (H)(1).
- (3) Water Service Pipe and Fittings:
 - (a) Copper Tubing. Copper tubing for water service lines 3/4" through 2" in diameter shall be Type K, soft temper copper tubing for underground service conforming to ASTM B-88 and ASTM B-251. The pipe shall be marked with the manufacturer's name or trademark and the type of pipe. The outside diameter of the pipe and minimum weight per foot shall not be less than that listed in ASTM B-251, Table II.
 - (b) PVC Water Service Pipe. PVC pipe and fitting for water services 1-1/2" and 2" will be allowed. PVC pipe and fittings for water service lines 3/4" to 3" will be allowed after the meter or on services longer than 60 feet in length. The pipe shall conform to ASTM D-1785 and unless otherwise specified, all pipe shall be CL 200 psi. All services 4" and larger shall conform to AWWA C-900.
 - (c) Fittings. All fittings for copper water service lines shall be brass and have flared or Mueller 110 type compression copper connections.

9-2-3: WATER DISTRIBUTION SYSTEM CONSTRUCTION SPECIFICATIONS

- (A) **General.** All pipe, valves, hydrants, manholes and other pipeline appurtenances shall be installed and tested in accordance with these specifications and manufacturer's instructions. When installation instructions or procedures differ, the Engineer will determine which will take precedence over the others.

Pressure pipelines covered by this specification include: water lines, force mains, siphons, pressurized irrigation lines and other lines that operate under a hydraulic head.

- (B) **Pipe Laying of Pressure Pipelines.** Pipe shall be laid on the alignment shown on the plans. Unless otherwise specified or approved, all pressure pipelines shall be laid to a minimum depth of 48 inches measured from the proposed final ground surface to the top of the pipe.

The inside of the pipe and jointing surfaces shall be kept clean and free from mud, dirt, gravel, ground water, and other foreign material. When pipe laying is not in progress the open ends of the pipeline shall be kept closed with watertight plugs. Long radius horizontal or vertical curves may be laid with standard pipe by deflections at the joints of rigid pipe or by deflecting the entire length of flexible pipe. Maximum deflections at pipe joints shall be per the manufacturer's recommendations or applicable AWWA Standard.

- (C) **Electrical Continuity.** All water mains and other pressure pipelines shall be buried with a continuous electrical tracing wire to enable future location of the pipe. Tracing wire shall be taped to the top of the pipe at 10-foot intervals to prevent dislocation of the wire during backfilling. The tracing wire shall be looped up to in all valve boxes and to the base of all fire hydrants shown on the *City Standard Drawings*. The wire shall be installed on the outside of the lower section of each valve box and the inside of the upper section to the lid. Tracing wire shall be terminated at the ends of all pressure pipelines as detailed on *City Standard Drawings*.

All ductile iron pipe with push on type joints shall be electrically connected with wedges or with cadweld connectors and No. 10 copper wire. The wire ends and cadwelds shall be sealed to prevent corrosion.

- (D) **Polyethylene Encasement.** Prior to backfilling, all cast iron and ductile iron pipe, fittings, valves and appurtenances shall be wrapped with polyethylene encasement material. All other metal pipes and fittings, except copper service lines, shall be wrapped with polyethylene encasement material. Polyethylene film shall have a minimum thickness of 0.008 inches (8mil). Installation of the polyethylene encasement shall be in accordance with one of the methods described in AWWA C-105. If a soil survey has been performed in accordance with Appendix A of AWWA C-105 and the soil is found to not be corrosive to ductile iron, the ductile iron pipe and fittings may be installed without a polyethylene encasement.

Ductile iron valves and fittings shall be fully encapsulated by the polyethylene encasement, except the valve-operating nut. The ends of the polyethylene shall be taped around the full circumference of the pipe. If the polyethylene is cut or more than one piece is used to wrap the valve or fitting, the pieces shall overlap a minimum of 12 inches and the full length of the seam shall be taped.

- (E) **Thrust Restraint.** Thrust restraint shall be provided at all pipe bends, tees, caps, valves, hydrants, and at the end of all stub outs or dead end lines. Thrust restraint may be provided by concrete blocking or mechanical restraints. Separately restrained in-line valves with a minimum of 20 feet of pipe are not required.

- (1) **Concrete Blocking.** The size and location of concrete blocking shall be as shown on the plans or in accordance with the *Standard Waterline Details*. Thrust blocks shall be poured on firm, stable foundation material and all bearing surfaces shall be against undisturbed earth.

Concrete for thrust blocks shall be made with modified Type II Portland cement and shall reach a minimum compressive strength of 3000 psi in 28 days. All anchorage steel not embedded in concrete shall be factory epoxy coated or Cor-Ten steel.

Fire hydrants shall be dry blocked as well as mechanically restrained, as shown on the *Standard Waterline Details*.

- (2) **Mechanical Restraint.** Valves and fittings may be restrained by mechanically connecting them to the pipe or other fittings. Fitting to fitting connections may be made with a flange-by-flange connection or an integral ring anchoring fitting by mechanical joint connection. Pipe by fitting connections may be restrained with a Megalug®, JCM®, Uniflange Series 1500® or other approved joint restraint. Where a short piece of pipe is installed between a fitting and a valve or other fitting, the restraint may be provided by connecting the mechanical joints with 5/8" stainless steel rod. The rod shall be connected to the mechanical joint fitting using tie-back bolts, not through the fitting's bolt holes. The rod shall be coated with an asphaltic sealant. All mechanical restraints shall be encased with polyethylene in accordance with Section (D) above.

- (F) **Installation of Water Service Pipe.** Where possible, underground water service pipes shall be laid not less than ten (10) feet horizontally from the building sewer drain. Where this separation is not possible, the service line shall be at least eighteen (18) inches above the top of the building sewer line.

Water services on ductile iron pipe shall be direct tapped. Tapping saddles shall be used on PVC pipe. Taps shall be at 45° above the springline of the pipe. If the tap is made while the main line is in service, a corporation stop shall be installed in the tap and turned so the T-handle will be on top.

- (1) **Service Stubouts.** The service line shall be installed from the main to the meter pit location shown on the Construction Drawings. The meter pit shall be installed so the top of the pit is within ½ inch of the proposed final ground surface elevation. The top of the pit shall be higher than the back of the adjacent sidewalk with a minimum slope of ¼ inch per foot from the pit to the back of the sidewalk. A meter setter shall be installed in each meter pit so the top of the setter will be 20 inches (+/- 2") below the top of the pit.

- (2) The service line shall extend to the back of the multipurpose or utility easement and marked either by a 4"x 4" board or steel fence post buried vertically. The board or post shall extend 3 feet above the ground surface with the exposed portion painted blue. The end of the service line shall be capped with watertight a plug.

Within the City of Montrose, installation on non-City water systems shall conform, at a minimum, to the City standards, or those of that particular system, whichever is more stringent. The company or organization operating the water main shall install meters.

- (G) **Sampling Stations.** Sampling stations are required for all new industrial/commercial or residential development. Sampling station installation is as follows: One sampling station shall be installed in each new subdivision of 40 acres or less. For subdivisions larger than 40 acres, one sampling station shall be installed for each 40 acres or portion thereof. The City Engineer shall approve sampling station locations.

- (H) **Backflow Prevention Devices.** A reduced pressure backflow assembly shall be required on all irrigation sprinkler systems, and any other connection to the service line, which presents a backflow or siphon potential, and contamination risk. All backflow prevention devices shall be installed in accordance with the Uniform Plumbing Code and manufacturer's recommendations. For water services to medium and high-risk installations, the assemblies shall be reviewed and approved by the City Engineer, or designated representative certified as a Cross Connection Technician, prior to installation.

All new or remodeled commercial buildings shall have an approved backflow prevention device installed within the building.

- (I) **Service Line Replacements and Reconnections.** Existing lead and galvanized steel water service lines shall be replaced with approved water service line materials as specified in 9-2-2 (H) (3). Other service lines may be replaced as directed by the City. The new service lines shall be connected to the existing meter with the appropriate fittings. Excavation of the existing meter pit shall be done in a careful manner to keep the pit intact for continued use.

Water services to be relocated shall be carefully excavated and disconnected to preserve the integrity of the pit, meter and components. The relocated meter shall be reconnected to the customer's service line with the appropriate fittings.

The City shall inspect the condition and configuration of the existing meter, fittings, and pit for all service line reconnections and relocations. The City may direct any or all of the components to be replaced or reconfigured to conform to current standards.

(J) **Connections to Existing Mains.** New water lines shall not be connected to existing mains in service until the new lines have been tested, disinfected, and accepted by the City. Where the connection of the new lines to old requires interruption of service, the City Engineer and Contractor shall mutually agree upon a date and time for connections which will allow ample time to assemble labor and materials. The Contractor shall notify all water users affected.

(K) **Relationship Between Water Lines and Sanitary Sewers.** To reduce the possibility of contamination of the domestic water supply in the event of a water line break or repair, the following construction techniques shall be used when a water line and a sanitary sewer line are installed in close proximity to each other. These requirements shall apply to main lines and service lines.

(1) If the sewer line is above and within 10 feet horizontally of the water line, the sewer line shall be installed through steel or ductile iron casing pipe or encased in reinforced concrete as shown on the *City Standard Details for General Utilities*. The casing pipe or concrete encasement shall extend a minimum of 10 feet on either side of the water line, measured perpendicular to the water line.

(2) If the sewer line is 18" or less clear distance below and within 10 feet horizontally of the water line, the sewer line shall be installed through a steel or ductile iron casing pipe or capped with concrete as shown on the *City Standard Details for General Utilities*. The casing pipe or concrete cap shall extend a minimum of 10 feet on either side of the water line, measured perpendicular to the water line.

In all cases, suitable backfill or other structural protection shall be provided to preclude the settling or failure of both pipes. Crossings of sewer and water lines shall not be at an angle less than 45 degrees nor shall a sewer line or water line be installed within 10 feet of each other unless approved by the City Engineer.

9-2-4: WATER LINE APPURTENANCE SPECIFICATIONS

(A) **Installation of Fire Hydrants.** Hydrants shall be installed at the locations shown on the Construction Drawings. They shall be plumb and set so that the bottom of the pumper nozzle is no less than eighteen (18) inches and no more than twenty-two (22) inches above finished grade as shown in the *Standard Waterline Details*. The depth of the water line shall be adjusted so the fire line, from the main to the hydrant, can be installed horizontally with a 4-1/2 foot bury depth and the fire hydrant set with the ground line within 1/2 inch of the finished ground level. If the depth of the water line cannot be adjusted because of conflicting utilities or other

constraints, an offset shall be installed on the fire line and rotated to achieve the proper bury depth of the hydrant or fire hydrant with a different barrel height shall be used.

A minimum of 1/4 cubic yard of washed gravel shall be placed around the base of the hydrant to insure proper drainage of the hydrant after use. All pipe and fittings between the water line and the fire hydrant shall be restrained with dry concrete thrust blocks behind the hydrant and mechanical restraints. The tee shall be restrained with concrete thrust block. Weep holes, which drain the hydrant, shall not be covered with concrete.

- (1) Fire hydrants shall be the dry barrel type and shall conform to AWWA C-502. The standard hydrant shall have a six-inch connection, a 5¼-inch main valve opening with Stortz hose connection, two (2) 2½-inch hose nozzles and one (1) 4½-inch pumper nozzle as shown on *Standard Waterline Details*. The hydrant barrel shall be marked with a circumferential rib to denote the intended ground line. The centers of the hose nozzles and pumper nozzle shall be at least 18 inches above the ground line mark. Fire hydrants shall be painted bright red with an alkyd enamel paint or an approved substitute.

Hydrants shall be of the "traffic" or "breakaway" design, having easily replaceable breaking devices for the grade line flange and operating stem that prevents damage to the barrel sections upon impact. The operating nut and nozzle cap wrench nuts shall be 1-inch pentagon, measured from point to opposite flat side at the base. The height of the nut shall not be less than one inch. The nozzle caps shall be removed and the operating nut opened by turning to the left (counter-clockwise). Nozzle caps shall be securely chained to the upper barrel section. The 2½-inch hose nozzles shall be National Standard fire hose thread. The pumper nozzle shall be a Mueller A-423, Clow Medallion 2545, Kennedy K81 or approved equal with the following requirements:

- (a) Outside diameter of male thread is 5.282 inches.
- (b) Diameter of root male thread is 4.932 inches.
- (c) Number of threads per inch is 4.
- (d) Pitch diameter is 5.12 inches.

- (B) **Installation of Gate Valves and Valve Boxes.** Each gate valve shall be installed in a vertical position and set on a concrete support block as shown on the *City Standard Drawings*. An adjustable slip type valve box shall be set into position during backfilling operations. The upper section of the unit shall be placed in proper alignment and adjusted so that its top will be at final grade. The completed valve box shall be vertically centered over the valve-operating nut. Each valve shall be checked for proper access and operation prior to paving.
- (1) Gate valves shall be resilient seat or resilient wedge type gate valves conforming to AWWA C-509. Valves shall have cast iron or ductile iron bodies and bronze mounted non-rising stems with o-ring seals. The stem and all wearing surfaces shall be bronze or other approved non-corrosive material. Valves shall turn left to open.
 - (2) Valve boxes shall be 5 1/4 inch diameter, slip type, sized for the type of valve and depth of bury. The lid shall have the word "WATER" permanently cast on the top. As shown on *City Standard Water Details*. A cast iron valve box and lid with debris cap shall be provided for each underground valve.
- (C) **Installation of Butterfly Valves.** Butterfly valves shall be used on main lines 12-inch and larger. Butterfly valves shall conform to AWWA C-504. The Contractor shall submit for approval by the Engineer, drawings and literature showing the type, class, principal dimensions and materials used for all parts of the valves and operator. All packing bolts shall be stainless steel. Each butterfly valve shall be installed in a vault. The diameter of the vault shall be as detailed on the plans.
- (D) **Vaults.** The vaults for air valves and butterfly valves shall be made of reinforced concrete pipe or a manhole riser section. The cover shall be a precast concrete lid with a cast iron manhole ring and cover. The diameter of the vault will be as detailed on the plans. The cover for the air valve vault shall be perforated if a riser pipe is not to be installed as shown on the *Standard Waterline Details*. The total area of perforations in the manhole cover shall be as detailed on the plans or specified by the Engineer.
- (E) **End Connections.** End connections of gate valves shall consist of mechanical or push-on (rubber-gasket) joints conforming to AWWA C-111 or flanged ends in accordance with ANSI B-16.1.
- (F) **Wrench Nuts.** Wrench nuts shall be made of cast iron and shall be 1 5/16-inches square at the top, 2 inches square at the base and 1-3/4 inches high.

- (G) **Bolts.** All packing bolts and valve bonnet bolts shall be stainless steel. All bolts for mechanical joints shall be Cor-Blue® bolts or approved equal. All bolts for flange connections shall be stainless steel bolts coated with anti-seize.
- (H) **Tapping Valves and Sleeves.** Connections for line extensions of 4" and larger lines may be made with tapping sleeves and valves. Tapping valves shall be furnished with flanged inlet end connections having a machined projection on the flanges to mate with a machined recess on the outlet flanges of the tapping sleeves and crosses. The outlet ends shall conform in dimensions to the AWWA C-115 for the flange and AWWA C-111 for the hub or mechanical joint connection, except that the outside of the hub shall have a large flange for attaching a drilling machine. The seat opening of the valves shall be larger than normal size to permit full diameter cuts. The tapping sleeve or cross shall be of the same manufacture as the tapping valve. Either the tapping valve or the tapping sleeve shall have a test plug. All packing bolts shall be stainless steel. All bolts for mechanical joints shall be Cor-Blue® bolts or approved equal. All bolts for flange connections shall be stainless steel bolts coated with anti-seize.
- (I) **Air Valves.** Air valves shall be of the type, class and size specified on the Construction Drawings. A separate isolation valve of the same size and pressure rating as the air valve shall be installed between the water main and the air valve. The isolation valve shall be a ball valve with a 2-inch square nut on top for operation. This valve shall be placed inside a standard valve box separate from the air valve as shown on *Standard Waterline Details*.
- (J) **Electrical Tracing Wire.** Electrical tracing wire shall be size No. 10, Type UF solid copper, and direct-bury wire. Splices shall be compression type designed for direct bury applications. Wire shall be taped to top of pipe.
- (K) **Corporation Stops.** Corporation stops shall be made of brass and shall be the same size as the service line. The outlet end of the stop shall be threaded in accordance with AWWA C-800, for use with Type K flared or Mueller compression copper service tubing. If the service line is tapped directly into the water main the inlet threads of the stop shall be tapered in accordance with AWWA C-800. If a tapping saddle is used, the inlet threads of the corporation stop shall be CC, not standard iron pipe threads.
- (L) **Tapping Saddles.** Tapping saddles for ¾" to 2" service connections shall be wide-body brass saddles with flat neoprene seals (Mueller BR2B Series or approved equal). The inside diameter of the saddle shall be approximately the same as the outside diameter of the pipe being tapped, so uniform pressure is applied to the full circumference of the pipe when the saddle is secured.

- (M) **Meter Setters.** Meter setters shall be brass and shall be the same size as the service line. The City standard meter setter is A.Y. McDonald – 4141-07731-2-WDQQ33, or approved equal. The inlet and outlet ends shall be threaded in accordance with AWWA C-800 for use with flared or Mueller compression fittings to the Type K copper service tubing. All setters shall be equipped with a ball type; yoke stop valves with an approved locking device and a dual check valve.
- (N) **Curb Stops.** Curb stops shall be brass ball valves with compression fittings. Curb stops shall be located inside the meter pit with the operating nut accessible from the surface by valve key.
- (O) **Meter Pits.** Meter pits shall be installed at the edge of the right-of-way, just beyond the back of sidewalk as shown on *City Standard Water Details*. Meter pits shall be as manufactured by Mid-States Plastics, Inc., or approved equal, tapered type of a modified polyethylene material, 36 inches in height. Pit diameter shall be 20 inches unless otherwise approved by the City. Meter pits shall be furnished with an aluminum dome with a cast iron outer lid and aluminum inner frost-proof lid.
- (P) **Reduced Pressure Backflow Prevention Devices.** Reduced pressure backflow prevention devices shall be the same as the service line and shall be approved by the Foundation of Cross-Connection Control and Hydraulic Research at the University of Southern California.
- (Q) **Sampling Stations.** Sampling stations shall be Eclipse #88 with lockable aluminum housing as manufactured by Kupferle Foundry, or approved equal. Sampling stations shall use standard 3/4" service line pipe and fittings to connect to main, including curb stop and curb box.

9-2-5: REMOVALS, EXCAVATION, BACKFILLING, AND RESTORATION SPECIFICATIONS

- (A) **Description.** For the purpose of this section, underground conduits shall be considered sanitary sewers, storm drains, water mains, irrigation lines or any other underground pipeline. Wherever the term "pipe" or "pipeline" is used it shall mean underground conduit.

This section covers surface removals, excavation, backfilling, compaction, disposal of surplus material, restoration of disturbed surfaces, and all other work required for the safe and proper construction of underground conduits.

- (B) **Survey Line and Grade.** All construction surveying and staking shall be performed by or under supervision of an Engineer or land surveyor registered in the State of Colorado. The Contractor shall use a laser instrument to maintain and control the line and grade of all gravity flow pipelines including sanitary sewers, storm drains and irrigation lines. Check points shall be set at 50 feet, 100 feet and 200 feet from the beginning of each reach of pipe to assure that the laser is on the correct line and grade.
- (C) **Street Cut Permits.** If required, a Street Cut Permit may be obtained from the Public Works Department prior to commencing the work.
- (D) **Removal of Structures and Obstructions.** The removal of structures and obstructions shall be in accordance with Section 9-4-3 of the *Street System Standards*. The Contractor shall remove surface materials and obstructions only to the widths necessary for excavation of the trench. All trees, shrubbery, fences, plantings and structures not designated for removal shall be protected or, if moved, restored to their original condition after construction is complete.
- Removal of concrete curbs, gutters, sidewalks, driveways, and asphalt pavement shall be along existing joints or neatly cut lines. All vegetation, concrete, asphalt, and other refuse removed from the construction limits shall be separated from suitable topsoil and backfill material, and hauled to a disposal site secured by the Contractor. Where the trench is in an unpaved area, clean topsoil suitable for final grading shall be stripped, stockpiled separately in approved locations, and restored to the original thickness after the trench is backfilled.
- (E) **Bracing and Sheeting of Trenches.** All trenches shall be properly braced, sheeted or otherwise supported to provide safe working conditions and protection of the work, workers and adjacent property. Bracing, trench shields and sheeting shall conform to the recommendations in the Occupational Safety and Health Standards for Construction (OSHA). Unless otherwise approved, all trench support materials shall be removed in a manner that will prevent caving of the sides and movement or other damage to the pipe.
- (F) **Trenches with Sloping Sides.** Where working conditions and right-of-way width permit, trenches in unimproved areas may be excavated with sloping sides in accordance with OSHA requirements. All soils shall be assumed to be OSHA Type C Soil, unless otherwise classified by a qualified soils technician. Trenching and other excavations shall not extend beyond existing easements, right-of-way or limits shown on the *Construction Drawings* unless otherwise approved by the property owner and the Engineer.

In streets, alleys or narrow easements, trenches shall be excavated with vertical sides, properly braced and supported, unless otherwise approved by the Engineer. Where trenches with sloping sides are permitted, the slopes shall not extend below a point 12 inches above the top pipe. The trench shall be excavated with the vertical sides below this point.

- (G) **Open Excavation Limits.** The length of open trench shall be kept to a minimum and shall not exceed the length necessary to accommodate pipe laying and backfilling operations unless otherwise approved by the Engineer. The Contractor shall be responsible for covering or barricading unattended trenches and excavations as necessary for protection of the public and the work. All trenches and excavations shall be backfilled at the end of each work day, unless otherwise shown on the plans or approved by the Engineer. The end of a trench may be left open overnight if the entire perimeter of the excavation is fenced, lighted and barricaded with construction equipment and/or Jersey barriers. An open excavation, piece of equipment or other obstruction without a proper lane closure, road closure or other approved traffic control shall block no traffic lane.
- (H) **Unauthorized Excavation and Pavement Removal:** Unless authorized by the Engineer, all removed pavement and excavations made beyond the lines and grades shown on the *Construction Drawings* shall be replaced at the Contractor's expense.
- (I) **Unstable Trench Bottom.** Where the excavation is found to consist of muck, organic matter or any other material that is determined, by the Engineer, to be unsuitable for supporting and maintaining the line and grade of the pipe, the trench shall be excavated to an additional depth as agreed upon by the Contractor and Construction Inspector/Engineer, and replaced with an approved granular stabilization material. Should the Contractor and Inspector/Engineer fail to reach an agreement as to the depth and/or method of trench foundation stabilization, the City may require the services of a Geotechnical Engineer to assist in determination of an appropriate method for stabilization, at the developer's expense.
- (J) **Bedding and Shaping Trench Bottom.** Trenches shall be excavated to at least six (6) inches below the pipe grade and backfilled to grade with approved granular bedding material. The bedding material shall be hand shaped and graded until the trench bottom is uniform and free from rocks, bumps, and depressions. A coupling or bell hole shall be dug at each pipe joint with sufficient length, width and depth to permit assembly of the joint and provide a minimum clearance of two (2) inches between the coupling and the trench bottom. After the pipe is joined, pipe-bedding material shall be placed and tamped under each pipe joint until all voids are filled. Care shall be taken not to displace the pipe from its line and grade.

(K) **Cutoff Walls.** Cutoff walls shall be installed along every utility line to inhibit the movement of ground water through the screened rock bedding. Cutoff walls shall be 5 to 10 feet long and consist of native material or imported material that has a permeability rate the same or less than that of the native material. Cutoff walls shall be constructed by discontinuing the installation of bedding and haunching material and installing approved native or imported material. Cutoff walls shall be installed at intervals not exceeding 200 feet on pressurized lines. On gravity flow lines, cutoff walls shall be installed on every line, 10 to 20 feet upstream of every manhole or box.

(L) **Rock Excavation.** Rock excavation shall consist of the removal of boulders or concrete measuring one-half (1/2) cubic yard or more, hard shale, sandstone or other bed rock which, in the opinion of the Engineer, requires for its removal the continuous use of pneumatic tools or drilling and blasting. Rock excavation shall be in accordance with Section 203 of the *CDOT Standard Specifications for Road and Bridge Construction*.

(M) **Stockpiling Excavated Material.** Excavated material shall be piled in accordance with OSHA guidelines in locations that will not endanger the Work, create traffic hazards or obstruct sidewalks and driveways. Fire hydrants, valve boxes, manholes and other utility access points shall be left unobstructed. Gutters and other watercourses shall not be obstructed unless other satisfactory provisions are made for runoff and street drainage.

All surplus material and excavated material unsuitable for backfilling shall be removed from the site and disposed by the Contractor in approved areas.

(N) **Dewatering Trenches.** Trenches shall be kept free of water during pipe laying operations by draining, pumping or other approved methods. The water level shall be maintained at least six (6) inches below the trench bottom throughout the placement of bedding, pipe laying, joining and backfilling operations. The dewatering shall be carried out so that it does not destroy or weaken the strength of the soil under or along the side of the trench. The City Engineer or his representative shall approve the method of disposal of trench water. Watertight plugs shall be installed in the ends of all water and sewer lines when the trench is not being dewatered.

Surface water from any source shall be prevented from entering the trench excavation. No additional payment will be made to the Contractor due to an unstable trench or pipe foundation conditions caused by surface water entering the trench.

- (O) **Backfilling Pipe and Structures.** Unless otherwise specified or approved by the Engineer, all backfill material shall be placed with moisture-density control in accordance with the typical trench detail shown in the *General Utility Details*. All backfill material shall be adjusted to near 2% of the optimum moisture for non-clay soils, and at optimum moisture to +4% for clay soils, prior to its placement in the trench.

A minimum of 24 inches of compacted backfill shall be placed over the top of all polyvinyl chloride (PVC) and polyethylene (PE) pipes before vehicles or heavy equipment are allowed to pass over the pipe. Less cover may be allowed only where *flow-fill* or other approved material is used for the pipe haunching and backfill material. Flow-fill shall meet the requirements of 9-5-10 of the *Concrete Standards*.

During initial backfilling, the Contractor shall take all necessary precautions to prevent movement or distortion of the pipe or structure being backfilled. Pipe haunching material shall be placed and compacted in even lifts on both sides of the conduit to six (6) inches above the top of the pipe. Above the bedding and haunching material, earth backfill material shall be placed full width in uniform layers not more than twelve (12) inches thick. Each layer shall be compacted to the required density with approved mechanical or hand tamping equipment. Hydro-hammers or other heavy compaction equipment shall not be used unless approved by the City Engineer. No hydro-hammer shall be used for compaction with less than 48 inches of cover over the pipe.

It shall be the Contractor's responsibility to make necessary excavations and to provide safe access into the excavations in accordance with OSHA Standards in order to accommodate compaction tests at all locations designated by the authorized Technician.

- (1) **Backfill Testing Requirements:** All backfill shall be frequently tested to insure that the required density is being attained. For every 400 lineal feet of trench and each branch or section of trench less than 400 feet in length, at least one compaction test shall be performed for each two-foot vertical depth of backfill material placed. The first test shall be taken approximately two feet above the top of pipe and the last test shall be at the pavement subgrade or 6 inches below the ground surface in unpaved areas. Compaction tests shall be taken at random locations along the trench and wherever poor compaction is suspected. If any portion of the backfill placed fails to meet the minimum density specified, the failing area shall be defined by additional tests, if necessary, and the material in the designated area shall be removed and replaced to the required density at the Contractor's expense.

The frequency of compaction testing may be reduced to one test for every 1000 feet of trench if full-time inspection is made during the backfilling operation by the Engineer or an independent testing laboratory and sufficient initial testing has been performed to demonstrate that the methodology being used achieves the required results. The methodology shall be verified for each soil type or trench condition encountered.

Failed compaction tests shall be immediately reported to the Inspector and the Contractor. A summary report of all compaction test results, including retests of failed tests and a test location map or other approved location format shall be submitted to the Project Engineer and to the Contractor. Compaction test results are required as a basis of acceptance of facilities by the City in accordance with 9-2-8.

- (2) **Backfilling Concrete Structures:** Concrete structures shall not be backfilled until the concrete and mortar therein has attained a minimum compressive strength of 2000 psi and can sufficiently support the loads imposed by the backfill. Earth backfill shall be placed simultaneously on all sides of the structure in layers approximately twelve (12) inches thick. Each layer shall be compacted in accordance with the requirements in Table 1, 9-2-1.

(P) **Granular Stabilization, Bedding and Haunching Materials.** Granular materials required for stabilization of poor subgrade soils, bedding of pipe and structures, and haunching around pipe shall meet the following gradation requirements:

Sieve Size	Percent passing, by weight	
	Pipe bedding & haunching (crushed rock)	Granular Stabilization (screened or crushed rock)
2 inch	- - -	100%
1 inch	100%	- - -
No. 200	20% max.	15% max.

Crushed rock shall be the product of crushing rock and gravel. The portion of the material larger than will pass a 3/8-inch sieve shall contain at least 50 percent of particles having two or more fractured faces. Not over 5 percent shall be pieces that show no fractured faces.

- (Q) **Earth Backfill Material.** Earth backfill material shall consist of approved materials developed from project excavations or imported from another source. To be suitable for backfill, earth material shall be free from muck, frozen lumps, ashes, trash, vegetation and other debris. All excavated materials that, in the opinion of the Engineer, are unsuitable for use in the backfill shall be removed from the site and disposed of by the Contractor at his expense. The maximum size of rock or clod allowed within 6" of any plastic pipe shall be one (1) inch. The maximum size of rock or clod allowed within 6" of a rigid pipe or structure shall be three (3) inches.
- (1) *Proof Rolling.* The Engineer or Construction Inspector may require proof rolling of the compacted backfill material to test for deflection or additional consolidation. The Contractor shall furnish a rubber-tired, self-propelled vehicle for proof rolling. Acceptable proof rolling equipment includes a loaded water truck or loaded dump truck. If while proof rolling, any visible deflection or rutting is observed, additional compaction of the backfill will be required.
- (R) **Restoration of Grounds.** The cleanup and restoration of grounds shall be a continuous process from the beginning of construction to final completion of the Work. The Contractor shall keep the work site free from accumulation of debris and waste material caused by his operation. In the case of point-location work to be performed later in the construction process, such as water line tie-ins, the restoration (but not the clean up) of the area adjacent to the point-location may be delayed until the point-location work is performed.
- (1) After the pipeline is backfilled, the area shall be cleaned and restored to the original grade and condition. The cleaning and restoration shall be kept up to no greater than 500 feet behind the backfill operations.
- (2) All fences, utilities, culverts, ditches, structures, grassed areas and plantings shall be replaced and restored to a condition equal to or better than that at the beginning of construction.
- (3) The restoration of asphalt and concrete surfaces and structures may be performed at the completion of a segment of the project. A segment is defined as one contiguous length of pipe installed.
- (S) **Restoration of Concrete and Pavement Surfaces.** The Contractor shall replace all concrete and pavement surfaces removed or damaged by his operation. All paving, aggregate base course and concrete replacement work shall be in accordance with the *Street System Standards*. Paving and/or patching for an entire project may be performed as a single operation.

Prior to paving or patching all edges that have been broken, raveled or otherwise damaged shall be recut to a neat line. Refer to section 9-4-3 of the Street System Standards.

9-2-6: PIPELINE TESTING

- (A) **General.** All pipelines shall be tested before final acceptance. The Contractor under direct control and observation of the Engineer or an approved independent laboratory, and a representative of the City of Montrose Public Works Department shall perform all testing. The Contractor shall furnish all labor, equipment, tools, water and other incidental items required to conduct the tests.

If a pipeline fails to meet the test requirements, the leak or other deficiency shall be located and repaired at the Contractor's expense. After the repairs or corrections have been made, the pipeline shall be retested. Repairs and retesting shall continue until the test requirements have been met.

- (B) **Testing Pressure Pipelines.** Water mains, force mains, siphons, irrigation systems and all other pipelines that will operate under pressure shall be tested for pressure and leakage in accordance with these specifications and AWWA C-600, Section 4. Although AWWA C-600 is for ductile iron pipe, the test procedures shall be used for PVC pipe also. Pavement or other permanent surfaces shall not be placed until all pressure and leakage tests are satisfactorily completed. If the section of pipe being tested includes components of an existing system or components installed by others, the testing shall be done so at the Contractor's risk.

- (1) **Test Pressure.** Unless otherwise specified, the test pressure for all pipes shall be double the maximum operating pressure at the lowest elevation of the test section or the class designation of the pipe plus fifty (50) psi, whichever is less. The minimum test pressure for water distribution lines shall be one hundred and fifty (150) psi.
- (2) **Filling.** The pipeline shall be filled with potable water at least twenty-four (24) hours before being subjected to the hydrostatic pressure test. Each section of pipeline shall be filled slowly and all air expelled by means of taps at points of highest elevation. If temporary taps are installed to fill the line or release the air, the corporation stop shall be removed and the tap plugged when the disinfection and testing have been completed.

- (3) **Pressure Test Procedure.** Pressure and leakage tests may be performed simultaneously or separately. The total time for the combined pressure and leakage tests shall be a minimum of two (2) hours for each section of pipeline. If separate tests are made, the pressure test shall be made first. The duration of the pressure test shall be a minimum of one (1) hour and the duration of the leakage test shall be a minimum of four (4) hours. The pressure of the leakage test may be reduced to one hundred and fifty percent (150%) of the maximum operating pressure that will occur on that portion of the line.

Leakage is defined as the quantity of water to be supplied to the section of pipeline being tested, which is necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

The specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. No pipe installation will be accepted if the leakage for the section of the line being tested is more than the rate calculated using the following formula:

$$L = (N \times D \times \sqrt{P}) / 7400$$

Where:

- L = Allowable leakage in gallons per hour
- N = Number of joints in length pipeline tested
- D = Nominal diameter of pipe in inches
- P = Average test pressure in psi gauge

The allowable leakage rates for typical pipe sizes and pressures, based on 20-foot joint lengths, within the City of Montrose water distribution system are as follows:

Allowable Leakage (gallons per hour per 1000 feet)				
Test Pressure	6" pipe	8" pipe	10" pipe	12" pipe
150 psi	0.50	0.66	0.83	0.99
160 psi	0.51	0.68	0.85	1.03
170 psi	0.53	0.70	0.88	1.06
180 psi	0.54	0.73	0.91	1.09
190 psi	0.56	0.75	0.93	1.12
200 psi	0.57	0.76	0.96	1.15

- (C) **Tracing Wire Continuity Test.** Each valve box shall be visually inspected to verify that the tracing wire has been properly placed. The Contractor, in the presence of the City inspector, shall test the continuity of the tracing wire in each direction from each valve box or hydrant. An electronic pipe locator shall be connected to the tracing wire and a strong signal shall be received along the pipeline to the next valve box. This test shall be performed prior to paving, for example, during pressure testing and/or backfill work.

9-2-7: DISINFECTION OF WATER LINES

- (A) **Disinfection Standard.** All water mains shall be disinfected in accordance with AWWA Standard C651-99. To coordinate with the Project 7 laboratory schedule, bacteriological test samples shall be taken Monday through Wednesday on regular workweeks. Special scheduling will be required for weeks with holidays in them.

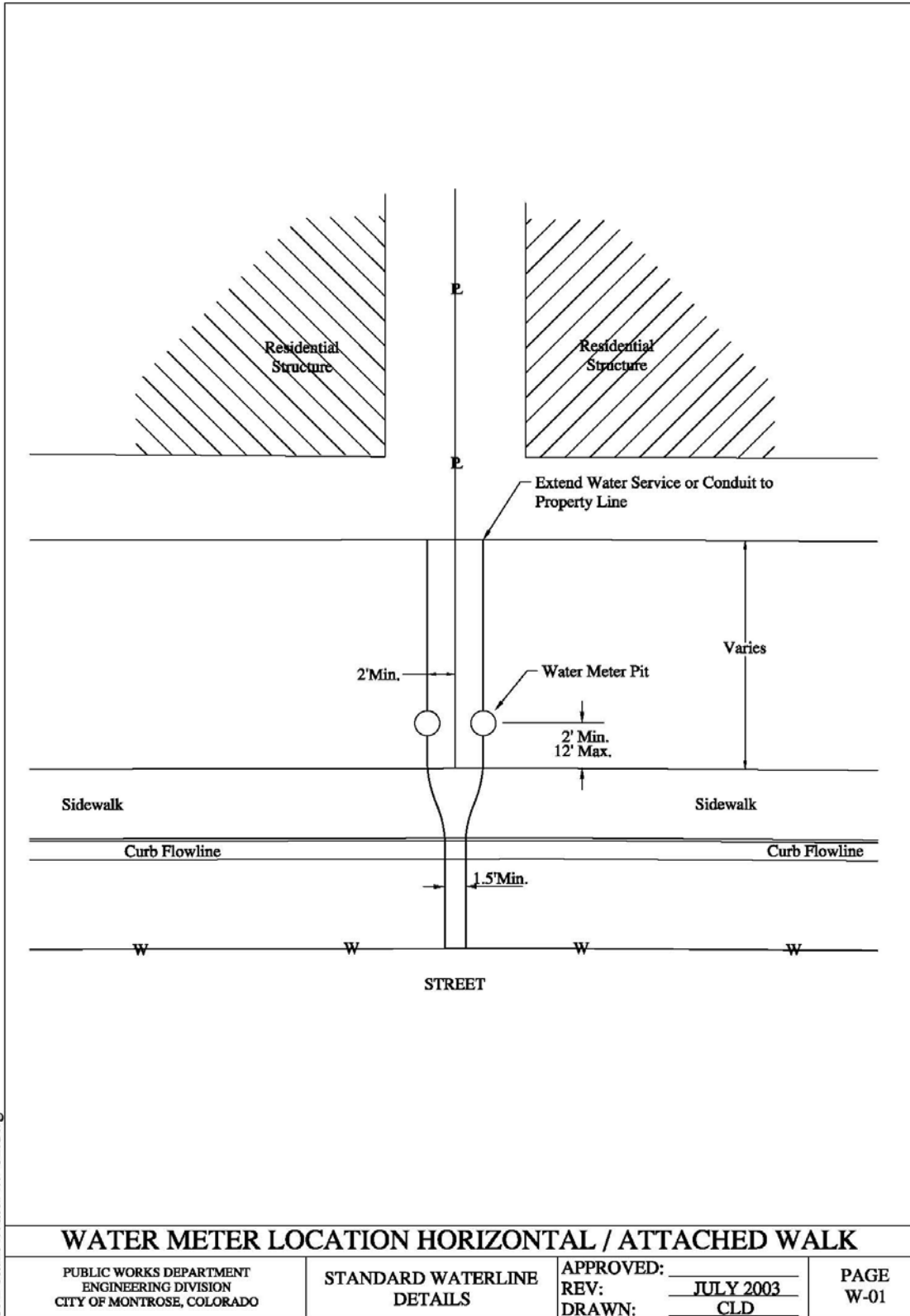
9-2-8: FINAL INSPECTION AND ACCEPTANCE

- (A) **General.** The acceptance of all pipelines by the City, based on red-lined as-builts of improvement facilities is required PRIOR to paving. Passing a final inspection of the Work by the City Engineer or his representative.
- (B) **Contractor's Warranty.** The Contractor shall guarantee his work to be free from defects in materials and workmanship for a period of not less than one year, the initial Acceptance Period. At the end of the 1-year initial Acceptance period and at the request of the Contractor the City Engineer and the Contractor shall jointly observe the work. The City Engineer may request such tests and inspections as deemed necessary, and consistent with these specifications. Any defects in the system resulting from defective materials, poor workmanship or any other cause attributable to the contractors work shall be corrected by the contractor, to the satisfaction of the City Engineer at the Contractor's expense.
- (C) **Inspection Results Submittal and Documentation.** Submittal of satisfactory results of tests (such as pipeline pressure test, leakage tests, disinfection tests, etc.) required to be performed by the Contractor and certified by the Engineer or an approved independent laboratory. For water lines, both potable and irrigation, all horizontal information shall be required on all service lines and main line fittings. Water line as-builts shall also identify material type. Submittal of all quality assurance test results in accordance with Table 1, Required Quality Assurance Testing, see section 9-2-1(C). Submittal of satisfactory results of required test (such as pressure test, leakage tests, disinfection tests, etc.) DOCUMENTATION OF TEST RESULTS SHALL BE REPORTED ON CITY-PROVIDED FORMS.

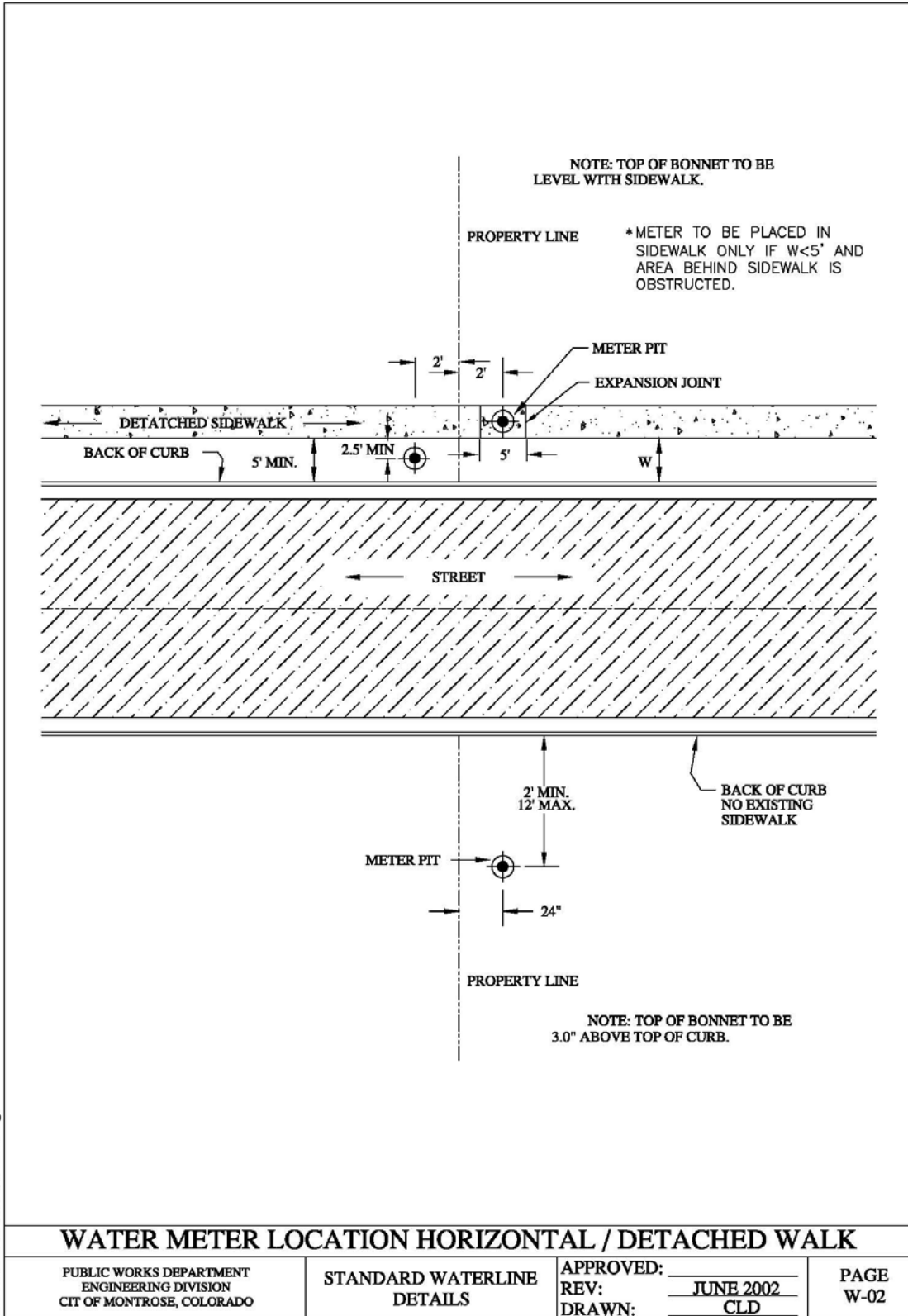
- (D) **As-Built Drawings.** Two sets of As-Built construction drawings shall be submitted on 24" x 36" or 22" x 34" paper or vellum in accordance with the Montrose submittal standards in Chapter 9-1. An Engineer shall stamp and sign all As-Built drawings prior to submittal. As-Built drawings shall also be submitted as an electronic AutoCAD file in accordance with the Montrose submittal standards in Chapter 9-1.

9-2-9: WATER SYSTEM DETAILS

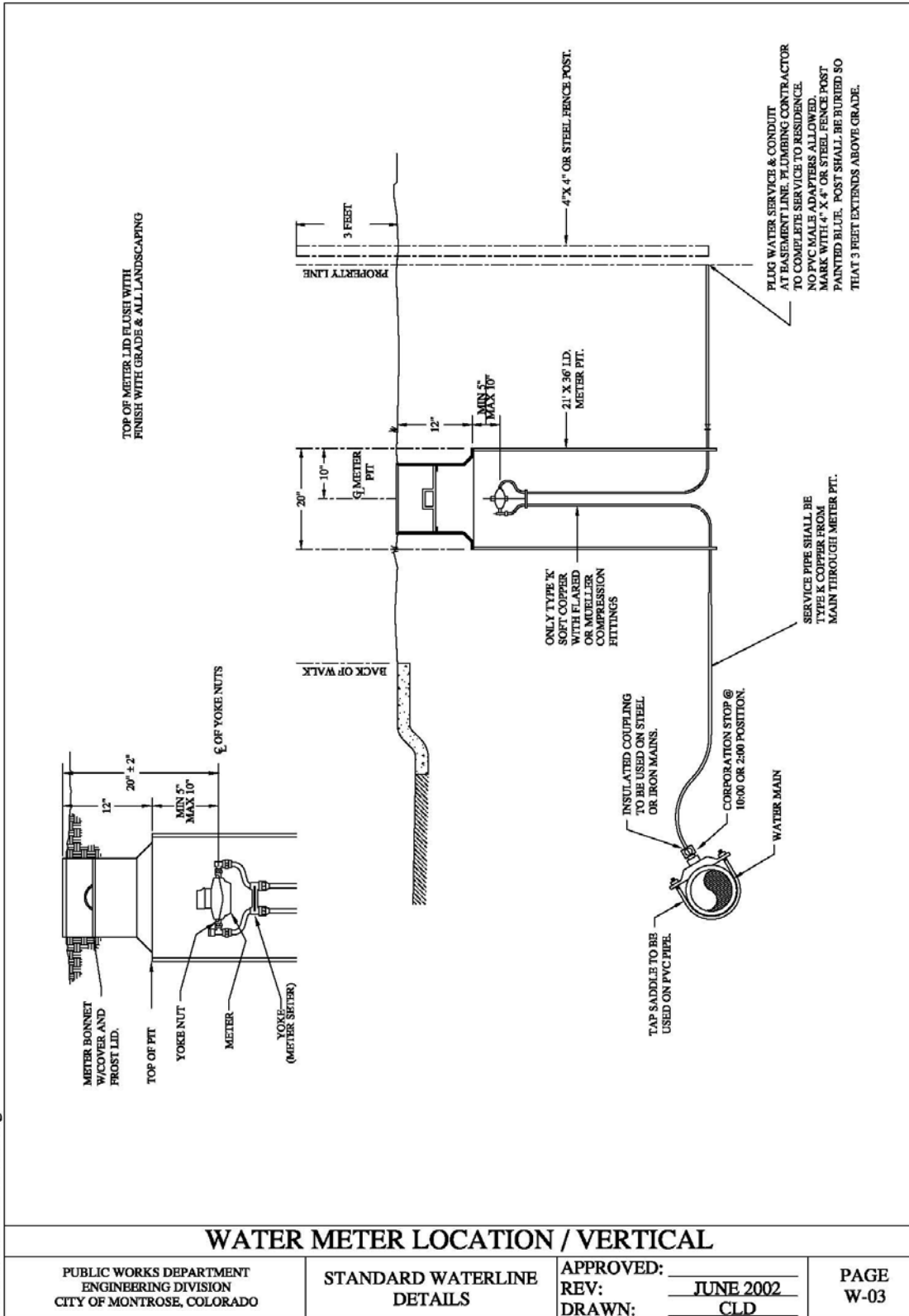
- W-01 Water Meter Location Horizontal / Attached Sidewalk
- W-02 Water Meter Location Horizontal / Detached Sidewalk
- W-03 Water Meter Pit Installation / Vertical
- W-04 Fire Line and Domestic Service Line
- W-05 1 ½" and 2" Meter and Vault
- W-06 4" and 6" Meter and Vault
- W-07 Thrust Block Details
- W-08 Table for Concrete Thrust Blocking
- W-09 Fire Hydrant
- W-10 Valve Box Assembly
- W-11 Air Release Valve
- W-12 Lowering for Utility Crossing – 12" or Smaller Water Line
- W-13 Field Installation Polyethylene AWWA C-105 Method "A"
- W-14 Valve Operation
- W-15 Standard Sprinkler Tap Detail
- W-16 Ditch Crossing Detail



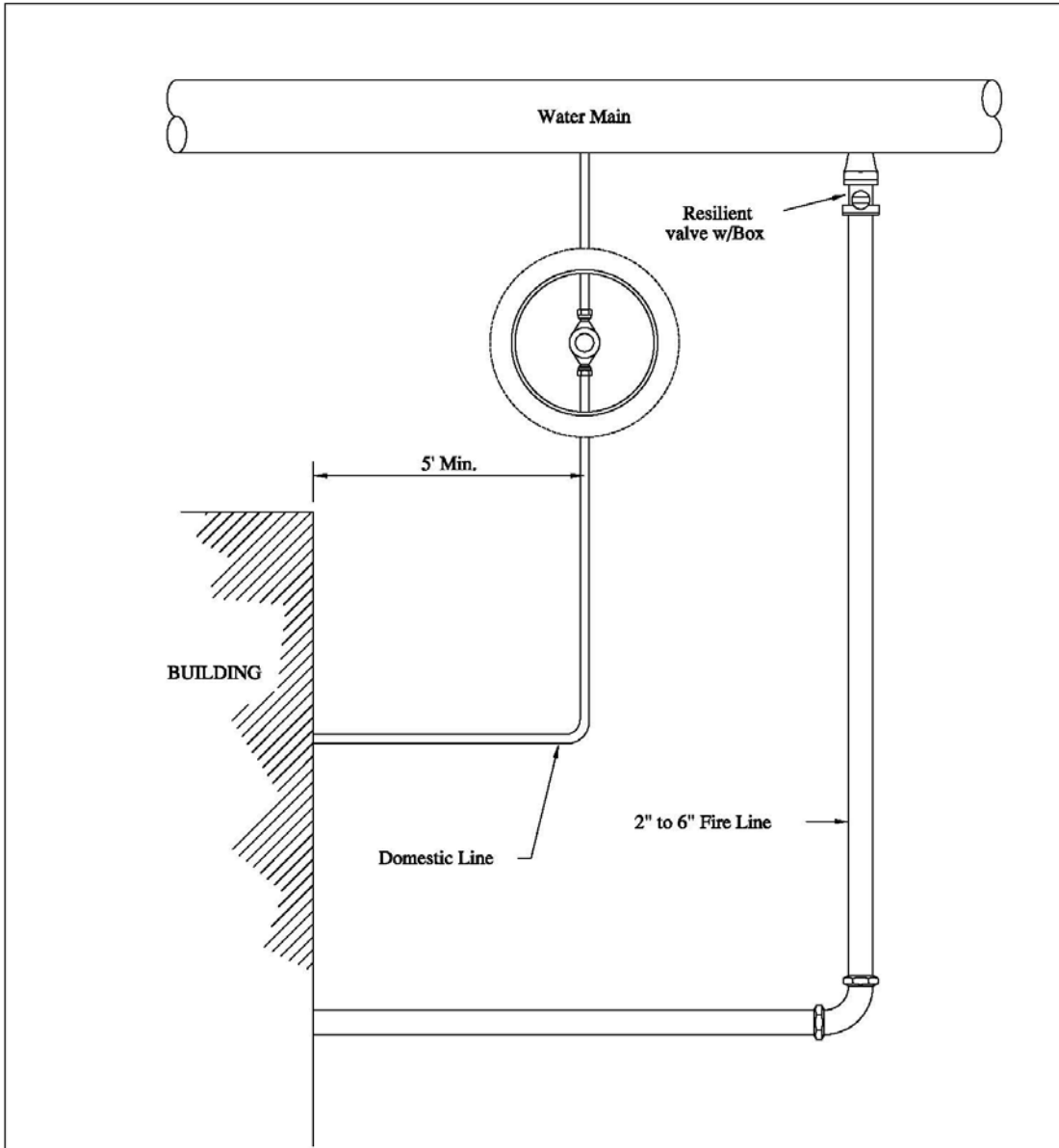
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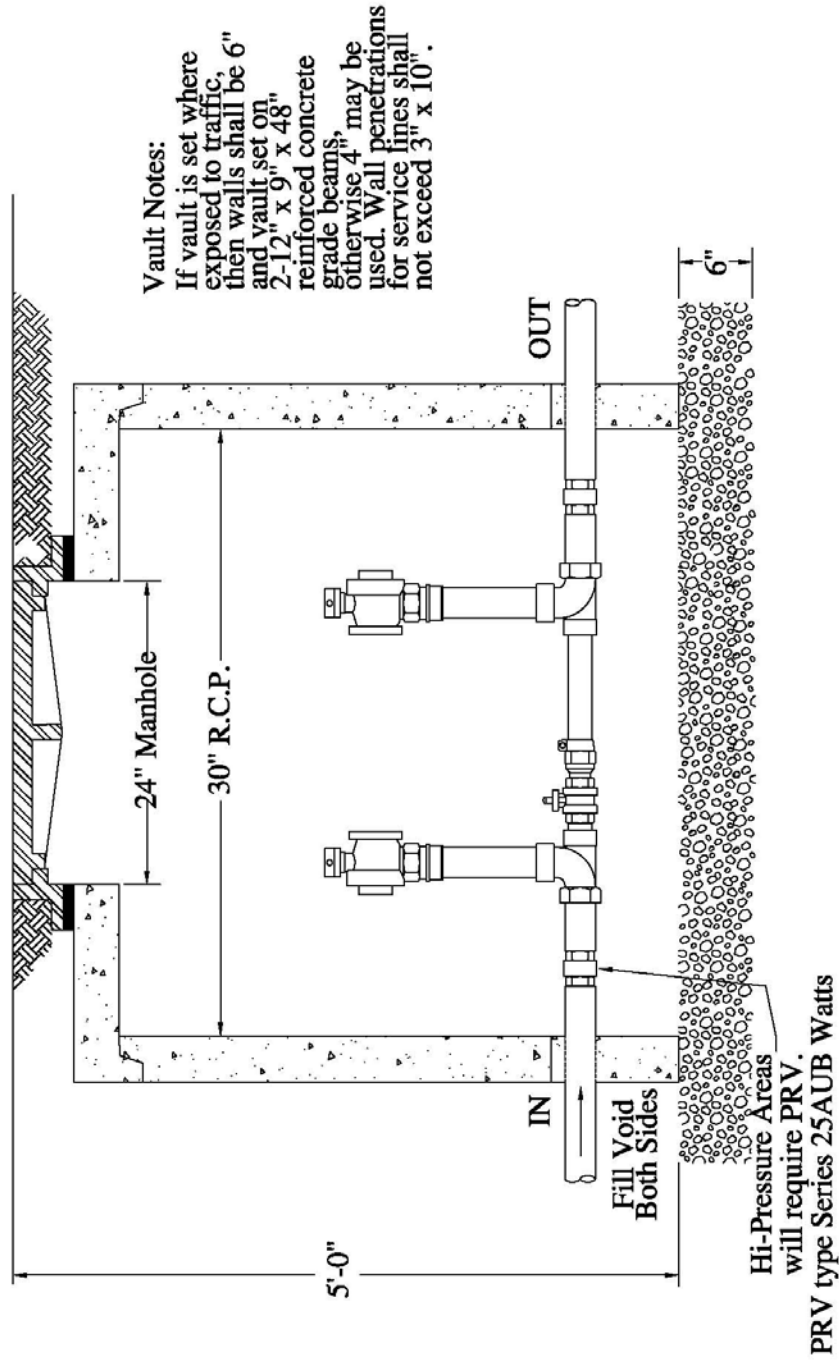
1. Service lines: All connections to be flared or Mueller compression.
2. Fire Lines: Backflow preventer on inside of building.
3. All services 3/4" to 2" shall be Type K copper only.
4. All 3" service lines shall be CL 200 psi PVC
5. All services 4" and larger shall be C-900.

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FIRE LINE AND DOMESTIC SERVICE LINE

PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION CITY OF MONTROSE, COLORADO	STANDARD WATERLINE DETAILS	APPROVED: _____ REV: <u> JUNE 2002 </u> DRAWN: <u> CLD </u>	PAGE W-04
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Type K-copper service & flared or Mueller compression fittings only.

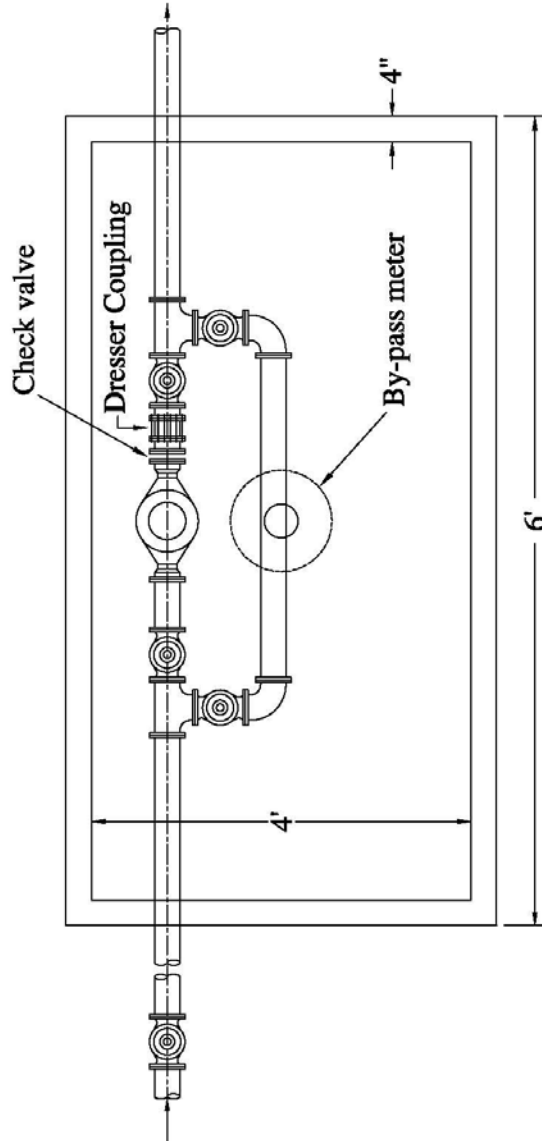


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1 1/2" AND 2" METER AND VAULT

PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION CITY OF MONTROSE, COLORADO	STANDARD WATERLINE DETAILS	APPROVED: _____ REV: <u>JUNE 2002</u> DRAWN: <u>CLD</u>	PAGE W-05
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1. For meters 4" and larger, meter support shall be a 8" x 8" x 12" concrete block set in gravel. Vault cover may be sectional (3 piece) to facilitate installation and removal. Valves to be Resilient seated valves.
2. Vault must withstand H-20 loading for placement within traffic areas.



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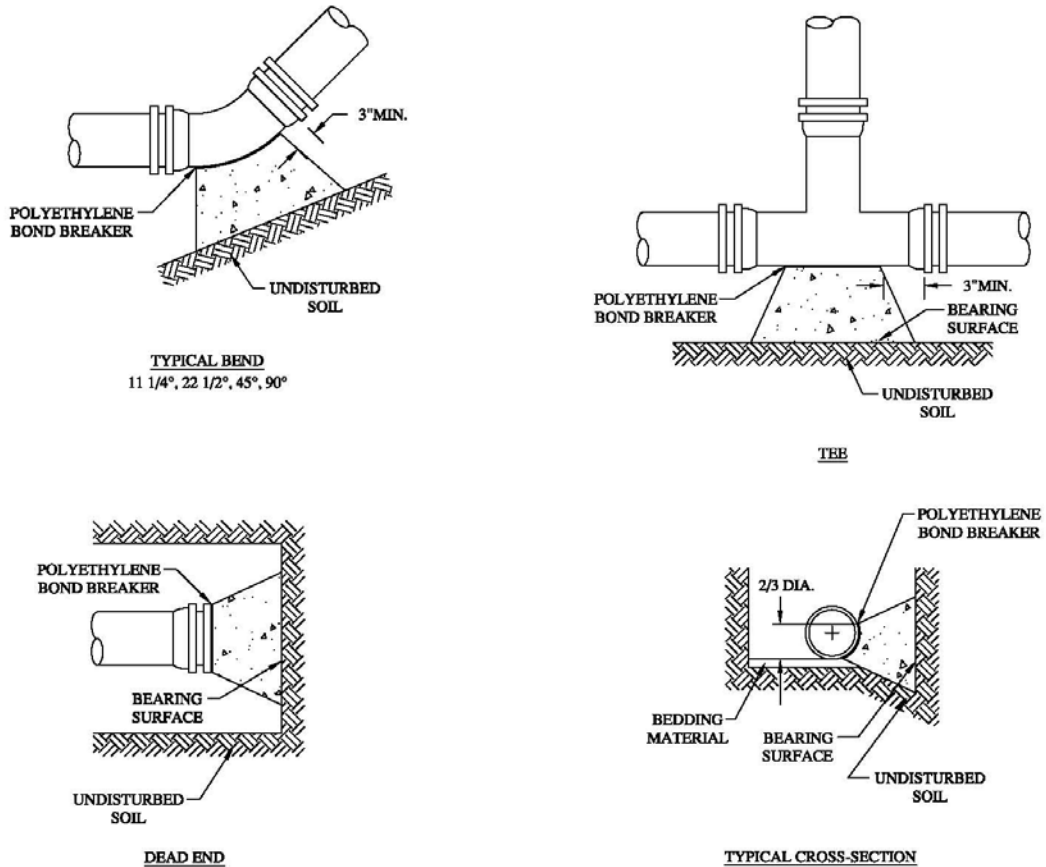
4" AND 6" METER AND VAULT

PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION
CITY OF MONTROSE, COLORADO

STANDARD WATERLINE
DETAILS

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TYPICAL BEND
11 1/4°, 22 1/2°, 45°, 90°

TEE

DEAD END

TYPICAL CROSS-SECTION

GENERAL NOTES:

1. All fittings to be wrapped with 8 mil polyethylene.
2. Pipe installed under conditions different from those normally encountered shall require thrust blocks designed for those particular conditions.
3. Thrust blocks on pipe larger than 12 inches diameter shall be designed for conditions existing at the installation site.
4. All thrust blocks to be 3000 p.s.i. concrete.
5. Mechanical restraints are to be installed in accordance with Water Distribution Standards section 9-2-3 (E)

TYPICAL THRUST BLOCK DETAILS

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PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION CITY OF MONTROSE, COLORADO	STANDARD WATERLINE DETAILS	APPROVED: _____ REV: <u>JUNE 2002</u> DRAWN: <u>CLD</u>	PAGE W-07
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BEARING AREAS (IN SQ. FT.)					
SIZE	BENDS				TEES, DEAD ENDS, AND CROSS w DEAD END BRANCHES
	90°	45°	22 1/2°	11 1/2°	
3	1.0	0.6	0.3	0	0.7
4	1.8	1.0	0.5	0	1.3
6	4.0	2.2	1.1	0	2.8
8	7.1	3.8	2.0	1.0	5.0
10	11.1	6.0	3.0	1.5	7.8
12	16.0	8.6	4.4	2.2	11.3
14	21.7	11.8	6.0	3.0	15.4
15	25.0	13.5	7.0	3.5	17.6
16	28.4	15.3	8.0	4.0	20.0
18	36.0	19.4	10.0	5.0	25.4
20	44.2	24.0	12.2	6.1	31.4
21	49.0	26.5	13.5	6.8	34.6
22	54.0	29.0	14.8	7.4	38.0
24	64.0	34.5	17.7	8.8	45.0
30	100.0	54.0	27.6	13.8	71.0
36	144.0	78.0	40.0	20.0	102.0

NOTE: TEE SIZE IS BRANCH SIZE.

AREAS GIVEN IN TABLE ARE BASED UPON INTERNAL STATIC PRESSURE OF 100 P.S.I. AND SOIL BEARING CAPACITY OF 1,000 lbs. PER SQ. FT.

BEARING AREAS FOR ANY PRESSURE AND SOIL BEARING CAPACITY MAY BE OBTAINED BY MULTIPLYING TABULATED VALUES BY A CORRECTION FACTOR "F"

$$F = \frac{\text{ACTUAL SPECIFIED TEST PRESSURE IN HUNDREDS OF lbs.}}{\text{ACTUAL SOIL BEARING CAPACITY IN THOUSANDS OF lbs.}}$$

SOIL BEARING CAPACITIES SHALL BE DETERMINED BY THE ENGINEER

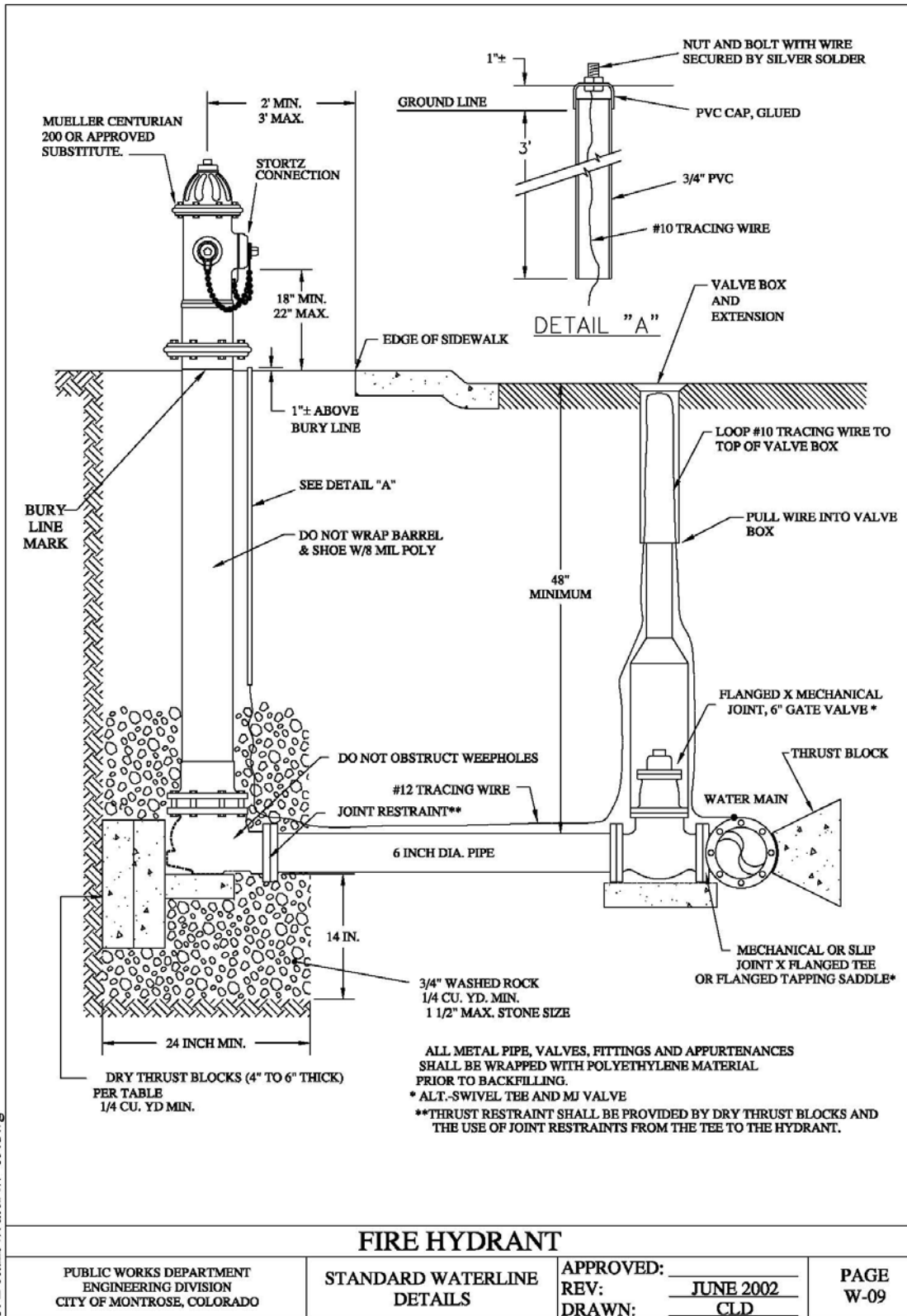
ALL WATER LINE PLANS SHALL CONTAIN THE FOLLOWING TABLE, WITH THE VALUES FILLED IN BY THE ENGINEER:

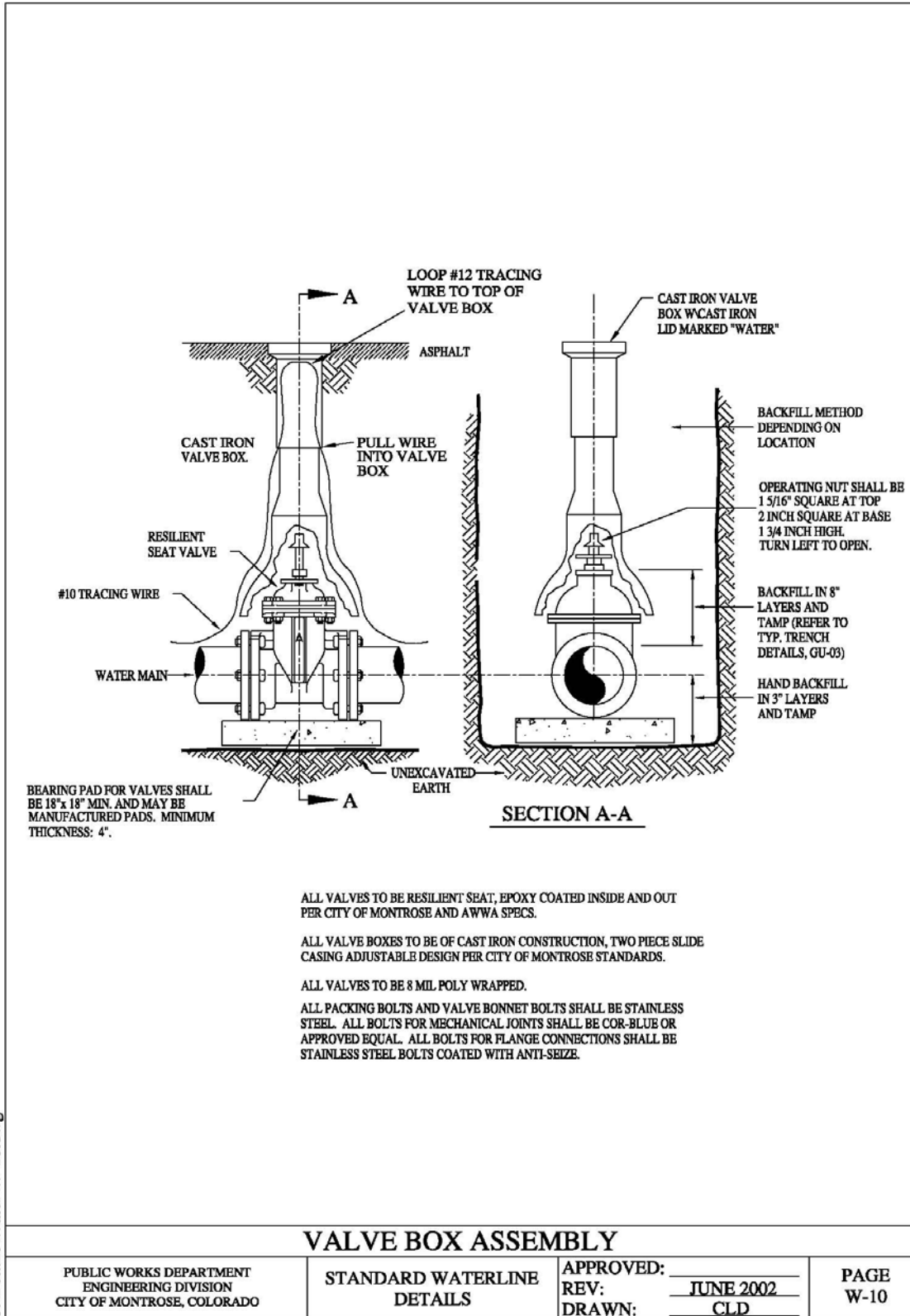
SOIL BEARING CAPACITY - _____ LBS/SQ. FT.
TEST PRESSURE - _____ P.S.I.
BEARING AREA MULTIPLIER (F) - _____

TABLE FOR CONCRETE THRUST BLOCKING

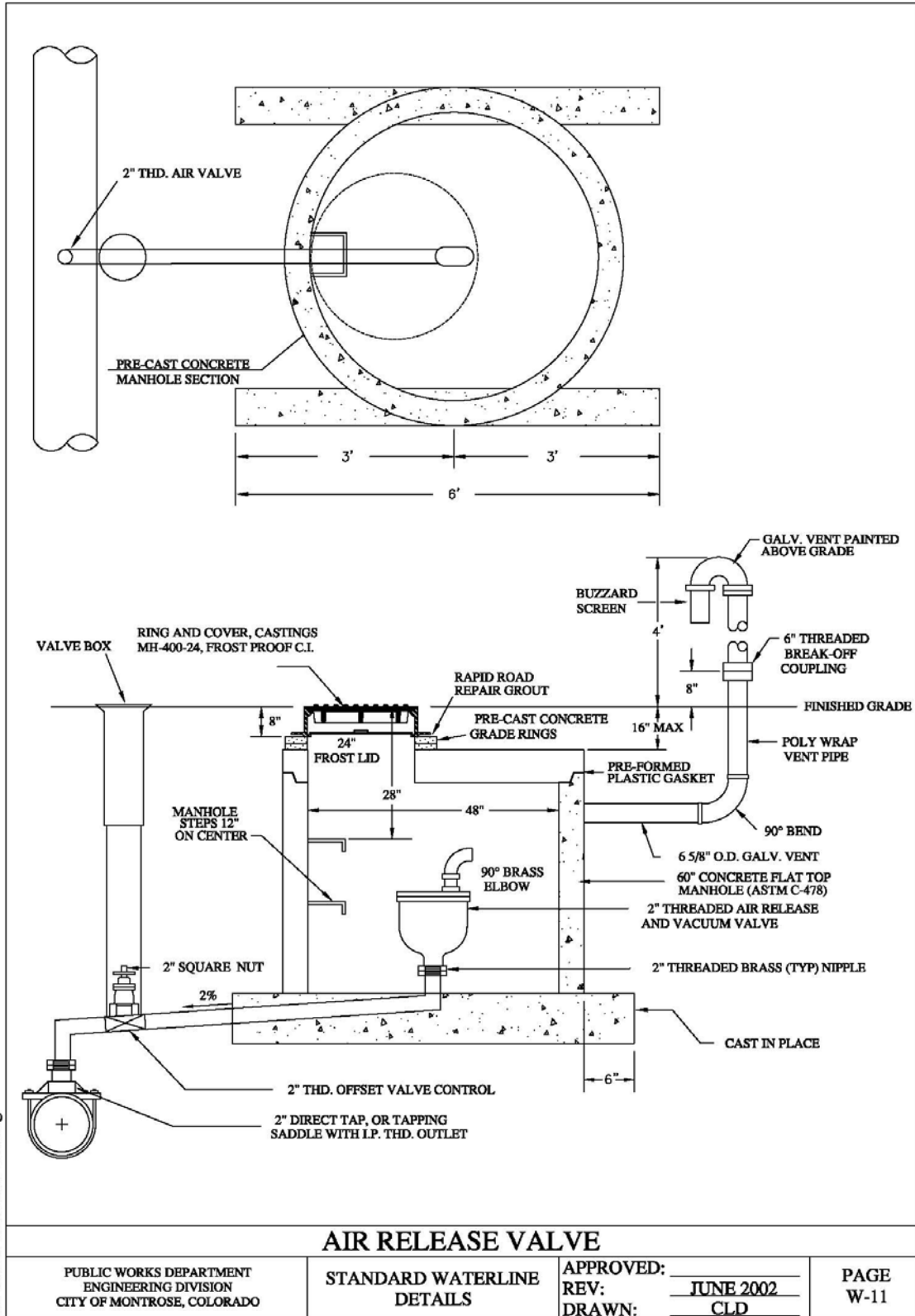
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PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION CITY OF MONTROSE, COLORADO	STANDARD WATERLINE DETAILS	APPROVED: _____ REV: <u> JUNE 2002 </u> DRAWN: <u> CLD </u>	PAGE W-08
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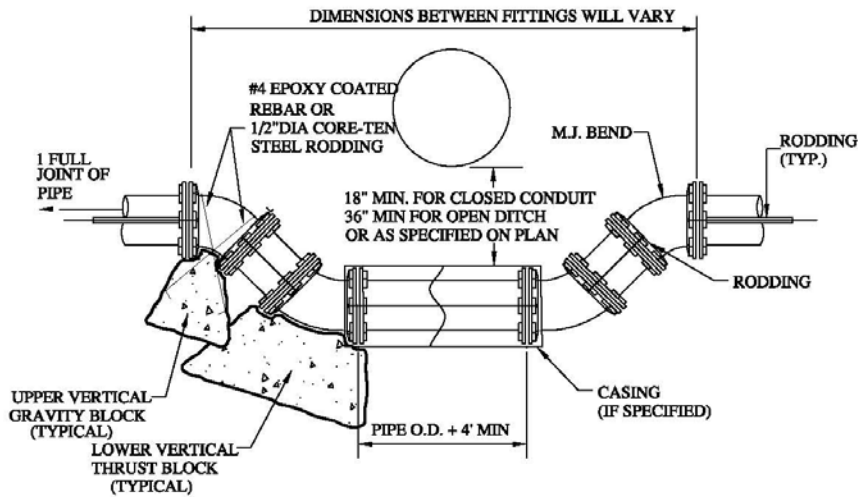




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NOTES:

- 1) SIZING OF VERTICAL THRUST BLOCKS BY DESIGN ENGINEER.
- 2) WHEN RESTRAINING PIPE BY MEANS OF RODDING JOINTS, 3/4" TIE RODS, NUTS, AND WASHERS WILL BE USED AND ARE TO BE MADE OF "COR-TEN" STEEL AS PER A.S.T.M. A242. SEE TABLE 1 FOR # OF RODS REQUIRED.
- 3) ALL METALIC PIPE, FITTINGS, AND APPURTENANCES WILL BE WRAPPED IN 8 MIL POLYETHYLENE.
- 4) REQUIREMENTS FOR LARGER THAN 12" DIAMETER PIPE WILL BE DETERMINED ON A CASE BY CASE BASIS.

TABLE 1

Pipe Size	Minimum number of Tie Rods
12" and less	2

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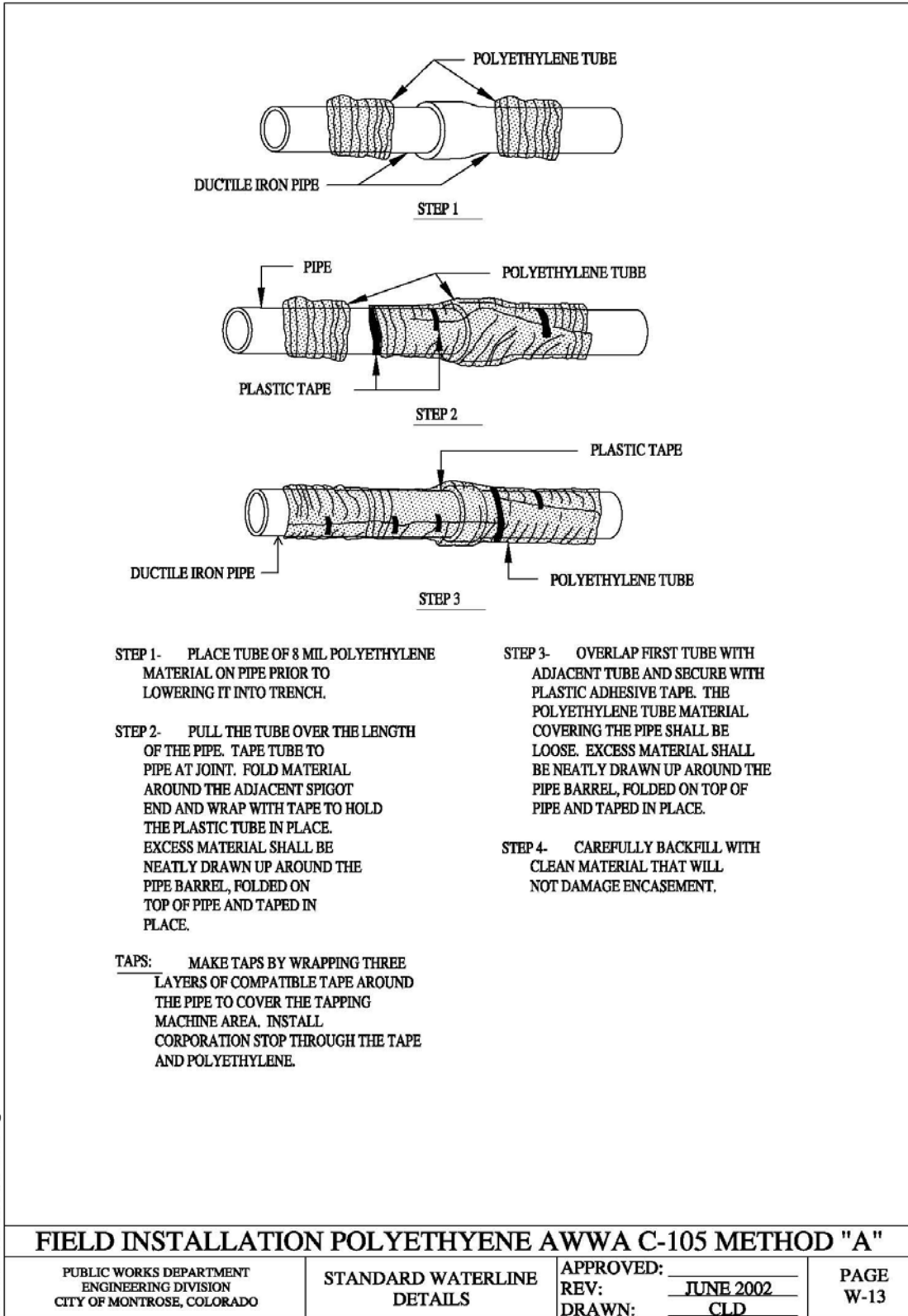
12" OR SMALLER WATERLINE, LOWERING FOR UTILITY CROSSING

PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION
CITY OF MONTROSE, COLORADO

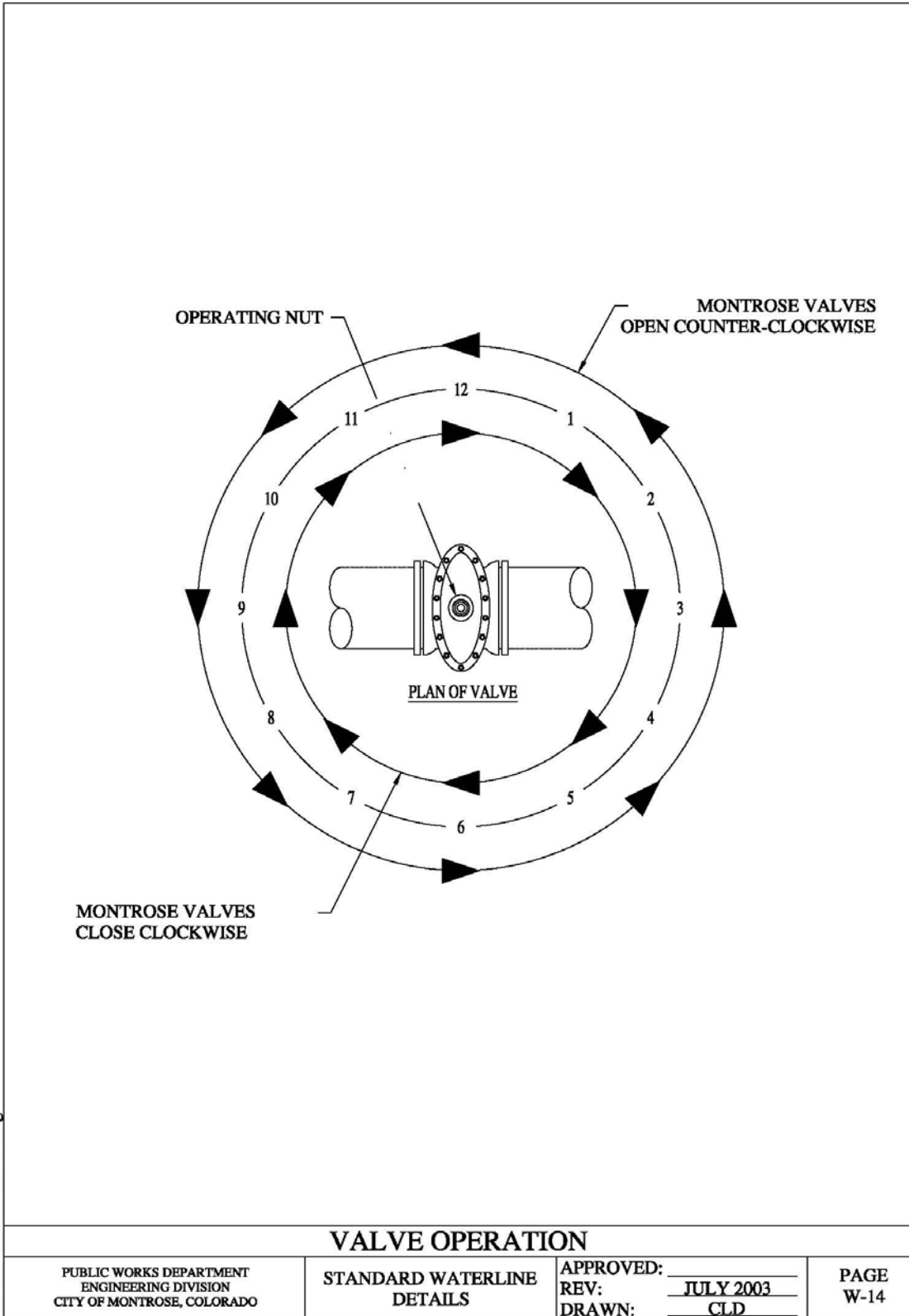
STANDARD WATERLINE
DETAILS

APPROVED: _____
REV: JUNE 2002
DRAWN: CLD

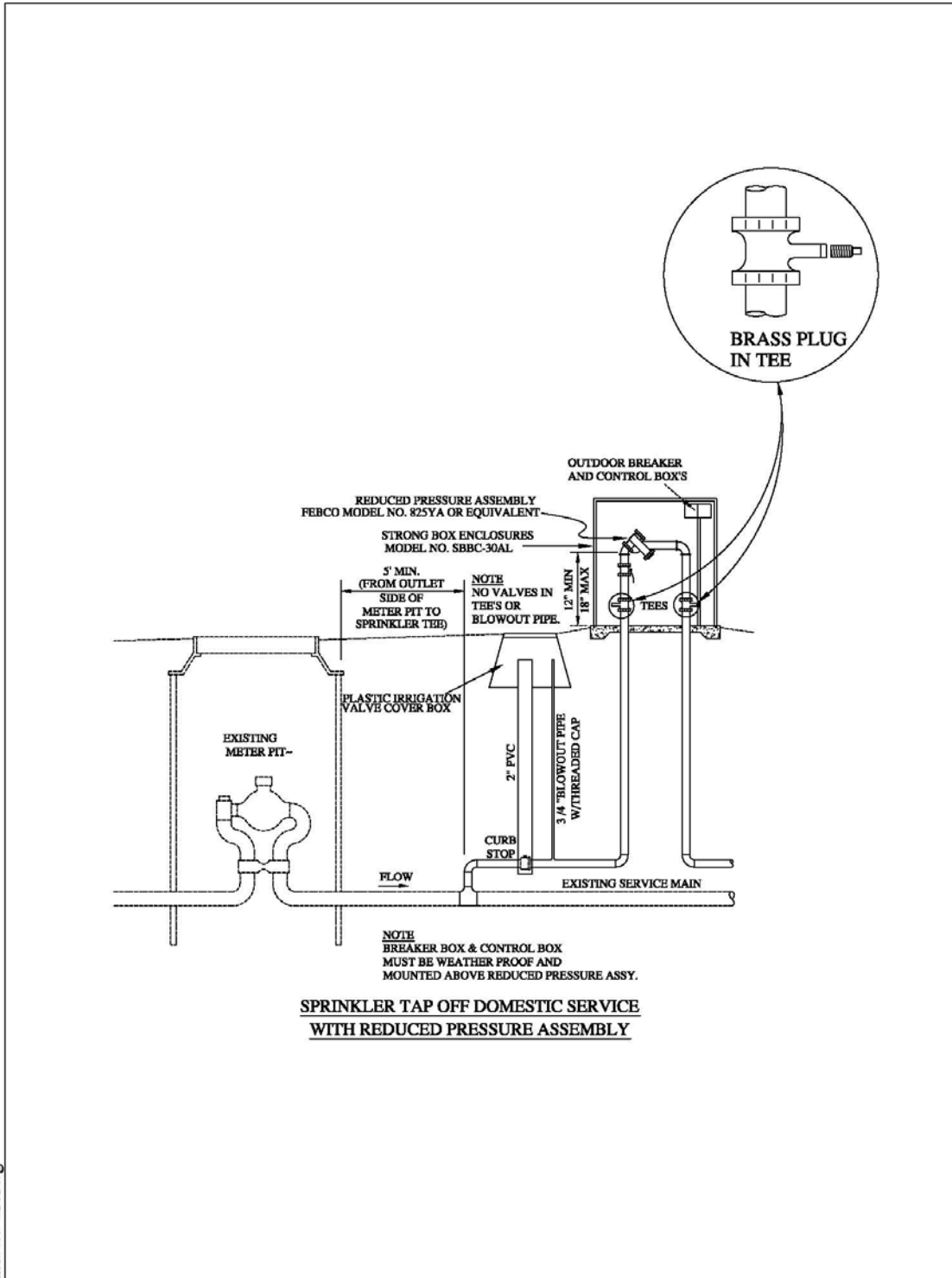
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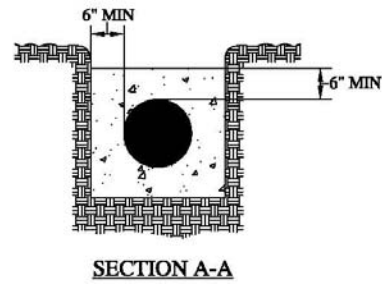
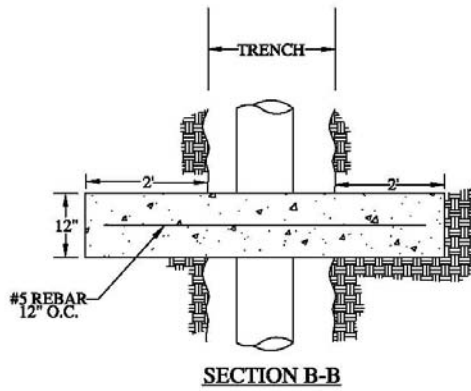
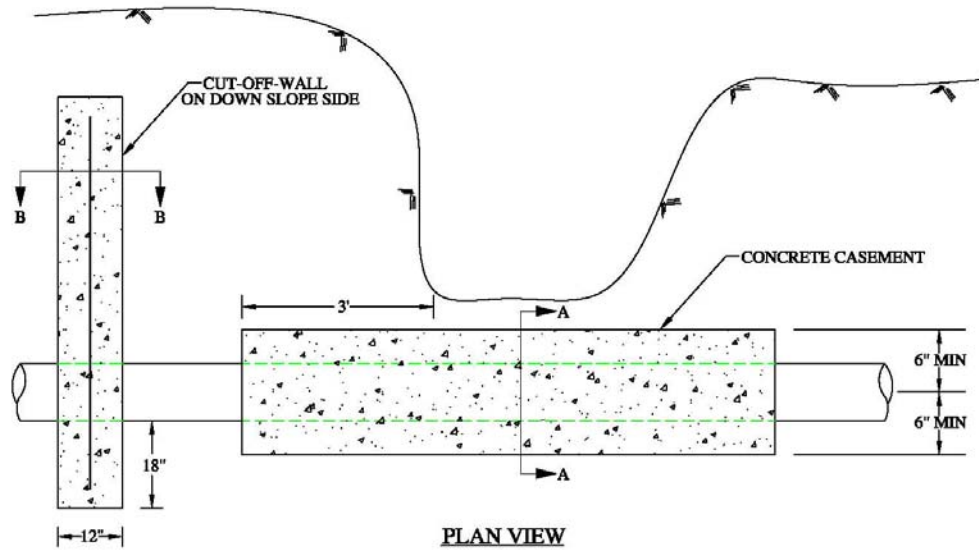
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STANDARD SPRINKLER TAP DETAIL

<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION CITY OF MONTROSE, COLORADO</p>	<p>STANDARD WATERLINE DETAILS</p>	<p>APPROVED: _____ REV: <u>JUNE 2002</u> DRAWN: <u>CLD</u></p>	<p>PAGE W-15</p>
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DITCH CROSSING DETAILS

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PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION
CITY OF MONTROSE, COLORADO

STANDARD WATERLINE
DETAILS

APPROVED: _____
REV: JUNE 2002
DRAWN: CLD

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CHAPTER 9-3

SANITARY SEWER SYSTEM STANDARDS

Sections:

- 9-3-1 GENERAL PROVISIONS
- 9-3-2 SANITARY SEWER SYSTEM DESIGN CRITERIA
- 9-3-3 SANITARY SEWER MATERIAL SPECIFICATIONS FOR PIPE, PUMPS, AND FITTINGS
- 9-3-4 SANITARY SEWER SYSTEM INSTALLATION SPECIFICATIONS
- 9-3-5 REMOVALS, EXCAVATION, BACKFILLING, AND RESTORATION SPECIFICATIONS
- 9-3-6 SANITARY SEWER PIPELINE TESTING
- 9-3-7 FINAL INSPECTION AND ACCEPTANCE
- 9-3-8 SANITARY SEWER SYSTEM DETAILS

9-3-1: GENERAL PROVISIONS

- (A) **General.** An Engineer shall design sanitary sewer systems. It is the responsibility of the Consulting Engineer to inform developers of the contents as set forth in the applicable local ordinances as it relates to the project under review and consideration by the Public Works Department.
- (B) **Future Extensions.** It should be noted that where it is determined that sewer mains are necessary to serve property beyond the subdivision or development in question, the developer will be required to design and construct his system, properly sized and at an appropriate location, to permit future extensions to be made at the limits of the subdivision or development in question. The system must terminate, at all points in new development, to within one lot from the adjacent and/or upstream properties to be served by the system in the future. Public sanitary sewer collection systems must be designed and constructed along major roads and/or through the development to facilitate for future extensions. In selecting routes for sewer mains, the Public Works Department requires that the location must be such that it maximizes the potential for serving areas and/or future developments.

- (C) **Quality Control and Quality Assurance.** Quality Control testing shall be in accordance with Section 9-1-1 (A). Quality Assurance shall be in accordance with Section 9-1-1 (B) and Table 1 below.

(1) Table 1 – Required Quality Assurance Testing

TEST REQUIRED	TEST PROCEDURE	REQUIRED OR ALLOWED RANGE	MINIMUM TEST FREQUENCY
Compaction of bedding and haunching materials (except crushed rock)	AASHTO T 99 And T 265	90% minimum (see notes)	1 per 400 L.F. of trench (and each branch or section of trench less than 400 feet in length) for each two-foot vertical depth of backfill material.
Trench Compaction to subgrade 1. Within right of way. 2. In unimproved areas outside of right of way or within landscaped areas.	AASHTO T 180 And T 265	95% minimum (see notes) Match existing or 85% minimum	
Compaction of aggregate base course material	AASHTO T 180 And T 265	95% minimum (see notes)	1 per 200 S.Y.
Compaction within 24" of all structures (manholes, catch basins, vaults, etc.)	AASHTO T 180 And T 265	95% minimum (see notes)	1 per each two-foot vertical depth of backfill material or per 100 L.F. of structure perimeter

Notes:

Compaction of Clay soils – Compaction requirements per test procedure at optimum moisture to + 4%

Compaction of Non clay soils – Compaction requirements per test procedure near optimum moisture +/- 2%

- (D) **Materials.** All materials used shall be new and in conformance with the applicable standards.

- (1) **Material Requirements:** All materials shall conform to the requirements of these specifications. The type, size and strength class of pipe, fittings and other materials shall be as shown on the Construction Drawings.
- (2) **Inspection and Testing:** All pipe shall be tested in conformance with the applicable standards. Testing may be witnessed by the Engineer's representative, or by an approved independent testing laboratory. Upon request of the Engineer, the Contractor shall provide a copy of certified test

reports indicating that materials conform to the applicable standards or specifications.

- (3) **Handling:** All materials shall be handled with equipment and methods adequate to prevent shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground. If any part of the coating or lining is damaged, the Contractor shall repair or replace the material at his expense as directed by the Engineer.
- (4) **Storage:** The Contractor will be held responsible for the safe storage and protection of all pipe and other materials delivered to the work site. The interiors of all pipe and fittings shall be kept free from dirt and foreign matter at all times. Gaskets for pipe joints shall be stored in a cool location out of direct sunlight. If sunburned pipe is utilized, the City requires that the contractor provide a manufacturer's certification that all warranties are still valid. The City reserves the right to reject sunburned pipe depending on the severity of the apparent damage. Any material that has been damaged before actual incorporation in the Work shall be repaired or replaced at the Contractor's expense.

9-3-2: SANITARY SEWER SYSTEM DESIGN CRITERIA

- (A) **General.** In cases where sanitary sewers are to be constructed on steep grades and velocities greater than 15 feet per second are indicated, solid wall PVC pipe or other abrasion resistant material shall be used. Clay dams shall be utilized where the possibility exists that ground or surface water will follow the sewer trench, causing damage or undermining of pipe bedding.

Sanitary sewers shall remain fully operational during the 100-year flood. Sewers and their appurtenances located along streams shall be protected against the normal range of high and low water conditions, including the 100-year flood. Sewers located along streams shall be located outside of the streambed and sufficiently removed from there to provide for future possible channel widening.

- (B) **Location of Sanitary Sewer Lines.** All sanitary sewers shall be located in existing or proposed streets and shall be constructed along the center of the street or center of the travel lane or center of alley. Exceptions to this specified location will be allowed only when it has been definitely shown that it is not practicable to adhere to the standard location. All sanitary sewers shall be laid on a straight line between manholes.

In a parallel installation sanitary sewer lines or manholes shall be at least 10 feet horizontally from any existing or proposed water main. The distance shall be measured edge to edge between the affective structures.

When local conditions prevent a horizontal separation of 10 feet, a sanitary sewer may be closer to a water line provided that:

- (1) The bottom of the water line is at least 18 inches above the top of the sewer; or
- (2) Where the vertical separation cannot be obtained, the sewer shall be one length of pipe at least 18 feet long centered over the water line. Joints between sewer pipe and special length pipe shall be encased in concrete per standard details; or
- (3) Non-structural pipe shall be reinforced with a reinforced concrete encasement per *General Utility Standard Details*.

(C) **Sewer Line Separation Requirements.** In a crossing installation, sanitary sewers crossing water mains shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer. When conditions prevent a vertical separation of 18 inches, the following shall be used:

- (1) Sewers passing under water mains shall be in accordance with Section (B) above.
- (2) Water mains passing under sanitary sewers shall be installed according to the *General Utility Standard Details*, and protected by following provisions:
 - (a) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main.
 - (b) Adequate structural support for the sewers to prevent excessive deflection of the joints and settling on and breaking of the water mains.
 - (c) A section of water pipe centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.
- (3) Where the sanitary sewer is installed parallel to a storm drainage structure, there shall be at least 10 feet horizontally, measured center to center, between them.

(4) Ductile iron pipe (Class 52) shall be used when crossing storm sewer and other rigid underground conduits when the vertical separation is 18" or less.

(D) **Sewer Lines Installed within Borings.** Carrier pipe within bores for sanitary sewer installation shall be meet CDOT specifications for crushability.

(E) **Sewer Lines at Railroad Crossings.** All sanitary sewer line crossings of railroads and, where required, roadways, and other major structures shall be encased in a carrier pipe. Design of railroad crossings shall comply with the requirements of Union Pacific Railroad, Utilities Installation Procedures. The Engineer shall be responsible for the preparation of the necessary application, in advance of construction or advertisement for bid, for submission by the City to the railroad or in a timely fashion as determined by the City Engineer.

(F) **Sewer Lines at Stream Crossings.** The tops of all sewers entering or crossing streams shall be a sufficient depth below the natural bottom of the streambed to protect the sewer line. In general, two feet of suitable cover shall be provided where the stream is located in rock and three feet of suitable cover in other material. Less cover will be considered if the proposed sewer crossing is encased in concrete and/or ductile iron pipe is used and will not interfere with future improvements to the stream channel.

Sewers entering or crossing streams, estuaries, lakes, or reservoirs shall be constructed of watertight pipe. The pipe and joints shall be tested in place and shall exhibit zero infiltration. Sewers laid on piers across ravines or streams shall be allowed only when it can be demonstrated that not other practical alternative exists. Such sewers on piers shall be constructed in accordance with the requirements for sewers entering or crossing under streams. Construction methods and materials of construction shall be such that sewers will remain watertight and free from change in alignment or grade due to anticipated hydraulic and physical loads, erosion, and impact.

(G) **Depth of Sanitary Sewer Lines.** All sewer mains and service lines shall be designed so that a minimum of four (4) feet of cover exists over the pipe after final grade has been established, unless specifically approved by the City Engineer.

Sewer mains and service lines which have less that four (4) feet of cover or more than twenty (20) feet of cover shall be installed using PVC pressure pipe, as specified in subsection 9-3-3(C). Under no circumstances shall a sewer have less than three (3) feet of coverage, unless specifically approved by the City Engineer in writing. Sewer lines that must cross under irrigation ditches or through bogs or swamps where the soil is unstable and water infiltration may be high, must be specifically designed by the Consulting Engineer and approved by the City Engineer.

- (H) **Sanitary Sewer Manholes.** Manholes shall be constructed in accordance with City of Montrose Standard Specifications for Construction of Underground Utilities and Standard Sanitary Sewer Details.

Manholes shall be located at the end of each line; at all changes in pipe size, alignment, grade and at sewer junctions. Maximum spacing between manholes on straight runs shall be 400 feet for sewers 15 inches or less and 500 feet for sewers 18 inches and larger.

Manholes subject to flooding shall be easily accessible and have watertight manhole covers. All manhole rims shall be 6 inches above the 100-year flood elevation, except where the rim would be more than 4 feet above the existing grade in which case watertight covers shall be used and manhole be set at a height 4 feet above final grade.

- (I) **Drop Manholes.** Drop manholes shall be used when the spring line elevation of the incoming sewer line exceeds the spring line elevation of the outgoing sewer line by 2' or more.

- (J) **Sampling Manholes.** Sampling manholes shall be installed at all commercial facilities located within business parks and industrial parks which includes but not limited to industrial facilities, food processing, metal processing, hospitals, animal hospitals, photographic finishers, printing shops, or any facility that the City feels may have an impact on the wastewater treatment plant.

(1) Physical design of the sampling point must be appropriate for the type of wastewater to be sampled. Manhole shall be located within fifteen feet (15') of the building and shall be accessible by City personnel at all times.

(2) For further information, contact the City Wastewater Treatment Personnel.

- (K) **Service Connections.** Service connections shall be provided in accordance with existing City specifications and details. Plugged service connections at full-body wyes are to be provided for all lots and parcels within the new development until extended to the dwelling unit. A minimum size of 4" diameter pipe is required for residential sewer lateral connections.

- (L) **Structural Design.** Structural requirements must be considered in the design of all sanitary sewers and appurtenances. This is a matter of detail design and is not subject to simple generalization. The Design Engineer should consider the following criteria:

- (1) Special Structures. Whenever possible sanitary sewer structures shall be built as shown in the *Sanitary Sewer System Details*. Structures other than those shown in the *Sanitary Sewer System Details* shall be considered special structures and shall be designed and detailed by the Design Engineer.
- (2) Pipe Foundation. In all cases the proper strength sewer pipe shall be specified for the proposed depth, width of trench and bedding condition. Soil condition should be considered with samples being obtained where necessary to verify pipe selection and foundation design.

(M) **Hydraulic Design For Sanitary Sewers.** In general, the pipe diameter should be continually increasing with increase in tributary flow. Where steep ground slopes make possible the use of a reduced pipe size and substantial economy of construction costs is thereby indicated, the pipe size may be reduced, but due hydraulic allowances shall be made to provide for head loss at entry, increased velocity, and effect of velocity retardation at the lower end where the flow will be on flatter slopes. In no case, should pipe sizes be thus reduced more than one nominal size in diameter.

Hydraulic computations shall be submitted to the Public Works Department for approval. Engineer shall submit with all sewer plans the information and calculations on sewer flow demands for the project. Upon receiving a written request from the developer and/or his agent and the information furnished by the Developer's Engineer, the Department will then provide the available sewer capacity. After evaluating this information on available capacities, the Engineer shall then furnish his calculations supporting that these demands can be met and that the sizing of the proposed sewer mains is adequate. The quantity of sewage for design purpose shall be determined by the future requirements of the total drainage area tributary to the section of sewer under consideration.

- (1) Average quantities of sewage, including allowable infiltration, shall be computed as follows:

	Gallons per day per acre	Equivalent Persons/Acre
Residential		
Low Density (1.0-3.0 dwellings per acre)	500	5
Medium Density (3.1-7.0 dwelling units per acre)	1,000	10
High Density (7.1+ dwelling units per acre)	2,500	25
Other		
Agriculture/Undeveloped Land	1,000	10
	Gallons per day per acre	Equivalent Persons/Acre
Commercial		
Business	2,000	20
Regional/Commercial	2,500	25
Industrial		
Light	2,500	25
General	3,500	35

- (2) Where site-specific determinations can be made, sewage flows may be determined by using the following design information:

Discharge Facility	Design Units	Flow gpd
Residential Units		
a) Single Family Units Includes Townhouses, Individual House Trailers	3.5 people/dwelling	350
(b) Apartments and Condominiums	4 people/3 bedroom apt	350
	3 people/2 bedroom apt	300
	2 people/1 bedroom apt	200
Schools with showers and cafeteria		
Elementary	Per person	16
High School	Per Person	25

Discharge Facility	Design Units	Flow gpd
Motels and Hotels – rooms only	Per person	130
Restaurants	Per seat	50
Service Stations	Per vehicle serviced	10
Factories	Per person/8 hr shift	25
Shopping Centers	Per 1000 sq ft of Ultimate Floor space	250
Hospitals	Per bed	300
Nursing Homes	Per bed	200
Homes for the Aged	Per bed	100
Doctors Office in Medical Center	Per 1000 sq ft	500
Laundromats, 9 to 12 machines	Per machine	500
Theaters, Auditorium Type	Per seat	5
Bowling Alleys	Per lane	75
Office Buildings	1000 sq ft ultimate floor space	200

- (3) Design flow shall be calculated using Colorado Department of Public Health and Environmental criteria. The Engineer should insure that the following design criteria are adhered to:
- (a) Sewers shall have a continuous slope, straight alignment and uniform pipe material between manholes.
 - (b) At all junctions where a smaller diameter sewer discharges into a larger one, and at all locations where the line increases in size, the invert of the larger sewer shall be set so that the energy gradients of the sewers at the junction are at the same level. Generally, this condition will be met by placing the pipes at crown's level where possible. However, as a minimum, placing the 80% depth of flow in each sewer at the same elevation.
 - (c) Sewers shall be designed to be free flowing with the hydraulic grade below the crown and with hydraulic slopes sufficient to provide an average velocity, when flowing full, of not less than 2.25 feet per second. Computations of velocity or flow rate shall be based on a value of "n" = 0.013 as used in the Kutter or Manning formula.
 - (d) In cases where the calculated depth of flow is less than the pipe flowing full, the velocity at actual depth of flow should be computed.

- (4) For sewage flow depth less than 1/4 full, allowance should be made for increased value of "n". In no case should velocities of less than 1.3 feet per second be permitted. Increased velocities shall be accomplished by steeper grades.
- (5) The following are minimum slopes in feet per hundred feet to be provided for pipes flowing 1/4 of full depth to full depth:

Pipe Size	8"	10"	12"	15"	18"	21"	24"	27"	30"	36"
Slope %	.40	.28	.22	.15	.12	.10	.08	.067	.058	.046

A minimum slope of 0.52% shall be maintained for terminal 8" lines not likely to be extended.

Minimum pipe size between manholes shall be 8".

- (6) In cases where sewers are to be constructed on steep grades for which high velocities are indicated, the maximum permissible velocity at average flow (before applying peak flow factor) should not exceed 15 feet per second. Suitable drop manholes shall be provided to break the steep slopes and to limit velocities to not more than 15 feet per second in the connecting sewer pipes between manholes.

Where drop manholes are impracticable for reduction of high velocity, the sewer shall be of solid wall PVC pipe or other abrasion resistant material.

- (7) Head Losses: Miscellaneous head losses at manholes, curves and junctions shall be estimated and allowed for as follows:
 - (a) At manholes on straight runs allow head loss = 0.05 feet.
 - (b) 90° turns made inside of manholes, where the radius of turn is less than 2 pipe diameters allow $0.50 V^2/2g$. If the radius of turn is greater than 2 pipe diameters, allow $0.25 V^2/2g$. In no case should the total allowance be less than 0.05 ft.
 - (c) At transitions and intersections of sewers larger than 24" in diameter, allow $0.50 V^2/2g$.

9-3-3: SANITARY SEWER MATERIAL SPECIFICATIONS FOR PIPE, PUMPS, AND FITTINGS

- (A) **General Specifications.** Pipe used in construction of gravity sanitary sewer mains and service lines shall be polyvinyl chloride (PVC). Sanitary sewers under pressure shall be PVC pipe and shall meet the requirements of ASTM D-2241 (IPS) or AWWA C-900.

The minimum pipe size for gravity sewers shall be 8" diameter for mains and laterals, and 4" diameter for service lines unless otherwise approved. Service taps for new construction shall be accomplished utilizing a full-body wye fitting. For taps into existing clay or concrete sewer lines, "Inserta-tees" manufactured by Inserta Fittings Company of Hillsboro, Oregon (503-357-2110) or approved equal will be used in accordance with the manufacturer's specifications. For existing PVC mains, tapping saddles will be used.

- (B) **PVC Gravity Sewer Pipe.** PVC sewer pipe and fittings shall conform to ASTM D-3034 Type PSM for diameters 4" to 15" and to ASTM F-679 Type I for diameters 18" to 27". The minimum wall thickness for PVC pipe shall conform to Standard Dimension Ratio (SDR) 35. Joints shall be bell-and-spigot type with flexible elastomeric seals conforming to ASTM D-3212 and shall not be longer than 13 feet in length. Gaskets shall be neoprene or other synthetic rubber material conforming to ASTM F-477. The bells shall be integrally formed with the pipe or fitting.

- (1) PVC Sewer Pipe and Profile Wall Pipe for Storm Drains, Low Head Irrigation Systems and Underdrains: PVC Sewer Pipe and fittings and PVC profile wall pipe and fittings shall meet the requirements of subsection (B) above.
- (2) Ribbed PVC pipe may be used for sizes 15" through 30". Ribbed PVC sewer pipe shall be seamless open profile and meet the requirements of ASTM F-794 and Uni-Bell UNI-B-9. Pipe shall have a smooth interior with a solid cross-sectional rib exterior. Exterior ribs shall be perpendicular to the axis of the pipe to allow placement of the sealing gasket without additional cutting or machining. The pipe stiffness shall be a minimum of 46 psi when tested at 5% deflection in accordance with ASTM D-2412.

- (C) **PVC Pressure Sewer Pipe.** PVC pipe used for sanitary sewers under pressure shall meet the requirements of ASTM D-2241 (IPS) or AWWA C-900. Joints shall conform to ASTM D-3139 and have elastomeric seals conforming to ASTM F-477. The type and pressure class shall be as shown on the Construction Drawings.

- (1) Fittings: PVC pipe fittings shall be fabricated of PVC material having a pressure rating equal to or greater than the pipeline used. PVC fittings may be used only with PVC pipe. When used with AWWA C-900 PVC pipe, sizes 4" through 8", the PVC fitting shall conform to AWWA C-907. When used with ASTM D-2241 pipe, the PVC fitting shall be of the same or higher class as the pipe and the pipe rating shall be reduced by 50%.

- (D) **Individual Lift Pumps.** Where a low pressure sewer system incorporating individual lift pumps at each house is approved by the City Engineer, the pumps, including controls and enclosure, shall be Environment/One GP2000 Series installed in accordance with applicable *Sanitary Sewer System Details*.

- (E) **Collection System Lift Pumps.** Where a lift pump associated with a gravity flow collection system is approved by the City Engineer, the pump, controls, and enclosure package shall be "Smith and Loveless Wet Well Mounted" installed in accordance with manufacture's recommendations.

- (F) **Manholes for Sanitary Sewers and Storm Drains.** Manholes shall be constructed as shown on applicable *Sanitary Sewer System Details*.
 - (1) Cement: All cement used in mortar, concrete bases, and precast manhole riser sections, cones and flat tops, for sanitary sewer manholes, shall be Type V or modified Type II Portland cement having less than five (5) percent tricalcium aluminate.
 - (2) Precast Concrete Manhole Sections: Manhole risers, cones, flat tops and grade rings shall be precast reinforced concrete sections conforming to ASTM C-478 or AASHTO M-199. Manhole risers, cones and flat tops shall be made with tongue and groove ends for continuous and uniform joints between sections. The joint sealant shall be a flexible, preformed, bitumastic joint sealant.
 - (3) Invert Epoxy Gel: All sanitary sewer manholes that are not constructed as a through manhole, pipe laid continuously through the manhole providing a PVC invert, shall have a minimum fall across the manhole of >0.16 feet. The concrete invert of the manhole shall have a steel trowel finish free of transverse or longitudinal trowel marks. Broom finishes are not acceptable.

In the event that 0.16 feet of positive fall can not be maintained across the manhole, the manhole invert shall be coated with an epoxy gel material suitable for feathering and vertical application. Epoxy coating shall be Dayton Superior, Resi-Bond (J-58), or approved equal.

The epoxy product shall meet, at a minimum, the following specification:

ASTM C-881, Type I, II, IV, and V, Grade 2, Classes B & C

Mix Ratio	1 Part A to 1 Part B by Volume
Color	Grey
Viscosity	2450 cps
Gel Time	6 to 8 minutes at 75 degrees F
Cure	2 hours
Compressive Strength	ASTM D-695: 10,100 psi at 7 days
Concrete Bond Strength	ASTM C-882: 2,500 psi at 2 days; 2,850 psi at 14 days;
Modulus of Elasticity	ASTM D695 339,000 psi
Water Absorption	ASTM D-570 - 0.59%

The epoxy shall be applied to a clean dry concrete surface free of dust, dirt, grease, laitance, curing compounds and other foreign matter by sandblasting, mechanical abrasion or hydro blasting. Air surface temperature during application and curing shall be 40 Degrees F or above. Mixing shall be accomplished using a low speed drill with a jiffy mixer or paddle. Epoxy shall be mixed in a clean dry container free of foreign matter or debris. Mixing rates shall be as recommended by the manufacturer.

In manholes with limited fall from pipe invert in to pipe invert out the concrete invert may need to be ground to allow continuous positive fall through the manhole. Mix epoxy in accordance with the manufacturers instructions. Epoxy may be brush applied in thin coats to provide a slick surface through the concrete invert of the manhole. Epoxy seems to perform best if applied prior to approximately the first ten to twelve minutes of pot life. The cured surface of the epoxy coating shall be free of brush marks and shall have a cross section consistent with that of the PVC pipe.

- (4) Manhole Waterproofing: Waterproofing is required on the exterior surface of base, riser sections and cone shall be coated with minimum 10 mil. coal tar epoxy. Waterproofing may be field applied.
- (5) Corrosion Protection: All drop manholes, force main outlet manholes, and lift station wet wells shall be coated on the interior surfaces of the riser and cone with a minimum 20 mil Dayton Superior Resi-Bond (J-58) or approved equal. Dayton Superior is to be shop applied to concrete after concrete has cured 28 days or steam cured over a 24-hour period or as required to meet the 28-day strength requirements. The epoxy shall be applied to a clean dry concrete surface free of dust, dirt, grease, and laitance, curing compounds

and other foreign matter by sandblasting, mechanical abrasion or hydro blasting. Air surface temperature during application and curing shall be 40 Degrees F or above. Mixing shall be accomplished using a low speed drill with a jiffy mixer or paddle. Epoxy shall be mixed in a clean dry container free of foreign matter or debris. Mixing rates shall be as recommended by the manufacturer.

Epoxy shall be applied in two coats to provide a minimum 20-mil thickness. Epoxy Performs best if applied within the first ten to twelve minutes of pot life. 20-mil thickness shall be verified using a wet mil gauge. Estimated coverage area of one gallon of the product is 80 square feet at 20-mil thickness.

Apply coating in accordance with manufacturer's recommendations and allow drying and hardening prior to transporting precast sections to the project. For application on existing manholes, Dayton Superior Resi-Bond (J-58) or approved equal, may be used with prior City approval. City inspection of the manhole is required prior to application of the product to ensure proper surface preparation has been accomplished. The manufacturer's recommendations for application in confined space areas shall be followed.

Alternative to epoxy coating is white, premolded plastic sheet linings such as the Amer-Plate "T-Lock" as manufactured by Ameron, Corrosion Control Division, Brea, CA or approved equal. Joint and welding strip shall be Amer-Plate "T-lock" or approved equal. All work in connection with the installation of the plastic lining in precast manhole sections is to be performed in strict conformity with the lining manufacturer's recommendation. After the structure is installed and backfilled, all surfaces covered with the T-Lock plastic lining, including welds, shall be tested with an electric holiday detector. The voltage and specific methods of testing is to be as recommended by the manufacturer of the lining material. In addition, all welds will be physically tested by non-destructive probing. All patches over holes, or repairs to the liner wherever damage has occurred, are to be installed in conformance with the instructions and recommendations of the liner manufacturer. The Contractor is responsible to obtain all testing equipment required to verify the integrity of the liner and welds. Holiday detectors are available from Tinker and Rasor, P.O. Box 281, 417 Agostino Road, San Gabriel, CA, (626) 287-5259. Additional information on T-Lock products can be obtained from Ameron International in Brea, CA, (714) 529-1951 or (800) 825-5075.

- (6) **Manhole Steps:** Steps are required in all sanitary sewer manholes. Manhole steps shall be a manufactured copolymer polypropylene plastic step with ½” diameter, Grade 60 steel core. The steps shall be set in the wall of the manhole riser at the time the riser is manufactured. For precast manhole bases with integral riser sections, the steps shall be installed at a 45-degree angle from the inlet pipe. The spacing between steps shall be such that when the manhole components are assembled the spacing is in conformance with OSHA Standards.
- (7) **Pipe-to-Manhole Connector:** Pipe-to-manhole connectors shall be manufactured with rubber conforming to ASTM C-923. All metal components shall be stainless steel.
- (8) **Rings and Covers:** Manhole rings and covers shall be cast iron dipped in asphaltic material to resist rusting. The standard City of Montrose manhole shall be Denver heavy pattern C.I. or approved, fully interchangeable substitute. The bearing surfaces between the ring and cover shall be machine finished or ground to assure non-rocking fit in any position and interchangeability. The cover shall have a beveled pick hole that has a width of ¾” at the top and 1” at the bottom. The length of the pick hole (along the circumference of the lid) shall be at least 1½”. The word SEWER shall be cast in the cover as shown on *Sanitary Sewer System Details*. Inverted rings and covers will NOT be allowed unless approved by the City Engineer.
- (9) **Watertight Manhole Covers:** Where a watertight manhole is required, the ring and cover shall be equipped with a gasket or o-ring, the cover shall have no holes that could allow the intrusion of water into the manhole, the ring and cover shall be drilled and tapped at 120° spacings and 3 stainless steel bolts shall be furnished to secure the cover to the ring. Anti-seize compound will be applied to threads PRIOR to installation.

The standard ring and cover for watertight manholes shall be Castings MH-250-D- CI, bolted and gasketed, or approved equal.
- (10) **Cast Iron Grade Rings:** Under no circumstances will cast iron grade rings be permitted for new construction. Cast iron grade rings that fit in the top of existing manhole rings shall be the same diameter as the existing ring and shall have three setscrews for attachment to the existing ring.

- (G) **Concrete and Mortar.** All concrete used in construction of manholes, inlet boxes, vaults, concrete encasement, thrust blocks, etc., shall meet the requirements of the *Concrete Specifications*, and shall be made with modified Type II Portland cement.

Cement mortar used in construction or maintenance of manholes, inlets, vaults, etc., shall be a non-shrink grout conforming to ASTM C-109 and ASTM C-191

Rapid-Road Repair grout or approved equal is recommended for setting the ring and cover on top of the concrete grade rings.

All-Crete 5 Minute Set (Fostroc Inc, Georgetown KY) or approved equal is recommended for invert work.

9-3-4: SANITARY SEWER SYSTEM INSTALLATION SPECIFICATIONS

- (A) **Installation of Gravity Flow Pipelines.** Gravity flow pipelines covered by this specification include: sanitary sewers, storm drains, culverts and non-pressurized irrigation lines. All sanitary sewer facilities shall be in compliance with design criteria of the Colorado State Department of Health.

- (B) **Pipe Laying of Gravity Flow Pipelines.** After the trench has been dewatered and the bedding prepared in accordance with subsection 9-3-5 below, the pipe shall be laid to the line and grade shown on the Construction Drawings. Variance from the designed location and elevation at the ends of every pipe section shall not be greater than three (3) inches horizontally and two (2) inches vertically while still maintaining minimum positive slope of the pipe. Variance from the design slope shall be within 0.04% of the design slope. At no point, however shall the slope be permitted to drop less than the allowed minimum positive slope of 0.40% or the design slope on the Construction Drawings, whichever is less. A deflection of up to 0.8 inches, creating a sag of not longer than 4 linear feet, will be allowed once in every 100 feet of pipe laid. If a sag is identified during lamping the sewer line, the line will be televised, closed caption, in accordance with subsection 9-3-6(L) to determine the severity of the deficiency.

The Contractor shall set the line and grade of each joint of pipe with a laser unless otherwise approved by the Engineer. The Contractor's surveyor shall set offset hubs at intervals of 50', 100' and 200' from the laser's location. Whenever the pipe is found to be outside the specified limits, the misaligned sections shall be removed and relayed to the correct line and grade at the Contractor's expense.

Pipe shall be laid upgrade from the point of connection to the existing sewer or from a designated starting point. Pipe with bell and spigot joints shall be laid with the bell end upgrade.

The inside of the pipe and jointing surfaces shall be kept clean and free from mud, soil, gravel, groundwater, and other foreign material. When pipe laying is not in progress, the upgrade end of the pipe shall be kept closed with a tightly fitting cap or plug.

(C) **Sewer Line Stub Outs.** Sewer line stub outs shall be no longer than 10 feet. The minimum length of a stub out shall be 18". Service connections to stub-outs are not allowed. Each stub out shall be connected to the manhole with a Kor-n-seal gasket , or approved equal, and plugged with a PVC cap that can be removed for future extension, yet still prevent ground water infiltration.

(D) **Installation of Sewer Service Lines.** Sewer service pipe within the public way shall be laid at a minimum grade of one-fourth (1/4) inch per linear foot unless otherwise approved by the Engineer. Flatter slopes between one-eighth (1/8) and one-fourth (1/4) inch per foot will be allowed only when there is not enough elevation difference to achieve one-fourth (1/4) inch per foot. A City Inspector prior to backfilling shall inspect sewer service pipe and connections to the sewer main. The Engineer shall establish the location and alignment of service lines.

The maximum deflection permissible at any one fitting or any combination of adjacent fittings shall not exceed 90 degrees. 90-degree fittings shall be the long radius type.

(E) **Small Diameter Taps.** Four-inch service lines shall be joined to the new sewer mains with a full-body wye fitting connected above the spring line of the sewer pipe. On existing PVC sewer lines the method of connection may be by the installation of a PVC tapping saddle with stainless steel straps. Where a tapping saddle is used, the hole in the main line shall be elliptical and slightly larger than that of the tapping saddle. The service line or wye shall not protrude beyond the inside wall into the sewer main.

(F) **Large Diameter Taps.** Six-inch or larger service taps shall be accomplished using a manhole. On 8" or smaller main lines in which projected flows will be less than 1/3 full, the 6" service line shall enter the manhole approximately 0.2' higher than the invert of the existing pipe.

(G) **All taps.** On existing non-PVC main lines such as concrete or clay, Inserta Tees, as specified in 9-3-3 (A), shall be used in accordance with the manufacturer's recommendations. Verify that the supplied tee is intended for the diameter and type of the existing pipe. At no point shall the tee protrude more than 1/2 inch into the existing pipe.

For the installation of sewer service lines to properties that will not be immediately connecting or reconnecting to the sewer system, the service lines shall be stubbed out to the house side of the multi-purpose easement, utility easement or right-of-way line where no easement exists. The end of the pipe shall be plugged and marked with either a 4" x 4" board or steel fence post buried vertically above the end of the pipe and extending 3 feet above the ground surface with the exposed portion painted green. The ends of the service lines shall be capped with watertight plugs braced to withstand test pressures. The horizontal location of each service tap shall be measured and shown on the As-Built drawings PRIOR to backfilling. The Contractor shall mark the end of the service with a post, as required above, with a reference mark and depth to the service pipe to be shot (for elevation) and documented at a later date. Tap locations shall be referenced using the stationing shown on the plans or referenced to property corners unless otherwise approved by the Engineer.

Where a PVC sewer service line is connected to an existing line, the connection shall be made with a Calder® coupling, or approved equal, of the style or with the adapters to be compatible with the pipes being joined. The coupling shall be encased in concrete. An alternative would be to use Mission type couplings with stainless steel bands. Mission type couplings need not be encased in concrete.

All service lines over 100 feet in length have a clean out installed in accordance with the Uniform Plumbing Code. When the clean-outs are within the right of way, the clean-outs shall be enclosed in a 24" diameter concrete barrel with a standard ring and cover suitable for traffic loads as shown on the *Sanitary Sewer System Details*.

Sub-drains and/or French drains shall not be connected to sanitary sewers.

Services for service stations, car washes, food-processing establishments shall have a grease and/or sand trap installed on their service lines. The trap shall be constructed to the requirements of the City Engineer.

- (H) **Construction of Manholes.** The foundation for each manhole base shall be prepared by replacing unsuitable material with subgrade stabilization material in accordance with subsection 9-3-5(I) and placing granular bedding material in accordance with the *Sanitary Sewer System Details*.

The manhole base shall be precast or cast-in-place. The lines and grades of the pipe inverts shall be staked, as shown on the Construction Drawings. The inverts of sanitary sewer manholes shall be formed and smoothly finished to match the shape and elevation of all pipes connected to the manhole. Where the sewer line is designed with a continuous grade and horizontal alignment through the manhole, the line may be installed through the manhole, the top half of the pipe cut out for a

length of at least 3 feet, and the manhole base formed around the bottom half of the pipe. A precast base with a precast invert may be used where there is at least 0.2 ft. of elevation difference across the manhole.

Sanitary sewer manholes inverts constructed with less than 0.16 ft. of elevation drop from pipe invert in to pipe invert out, and not constructed with the sewer pipe laid through the manhole as described above, shall be coated with an epoxy gel material as specified in subsection 9-3-3(M). The concrete invert shall be formed or removed to a depth to allow room to apply the epoxy coating to match to pipe invert and maintain positive fall through the manhole. The cured surface of the epoxy coating shall be smooth, free of trowel marks and shall have a cross section consistent with that of the PVC pipe.

All drop manholes, force main outlet manholes and lift station wet wells shall be coated on the interior surfaces in accordance with subsection 9-3-3(M).

Waterstops shall be installed on all pipes going into or out of a cast-in-place base. Waterstops shall be placed on both the uphill and downhill sides of the manhole on pipes laid continuously through a manhole. For precast bases the pipes shall be connected to the base with flexible rubber boots with stainless steel straps.

If cast-in-place bases are used, the first pre-cast manhole section shall be placed on the concrete base structure before the base has taken initial set, or the section shall be grouted into a suitable groove formed in the top of the manhole base. The first section shall be adjusted to the proper grade and alignment so that it is uniformly supported by the base concrete and not bearing on any of the pipes. The manhole steps shall be located one-foot left or right of the main inflow pipe.

The remaining pre-cast sections shall be placed and aligned to provide vertical sides and alignment of the ladder rungs. Plumbness shall be checked as each barrel section is added. A bitumastic or other approved sealer shall be placed between pre-cast sections so that the completed manhole is rigid and watertight.

The manhole ring and cover shall be adjusted to the final pitch and grade with mortar and precast concrete grade rings. The total height of grade rings shall not be more than twelve (12) inches. Grade rings shall be dry stacked and the cast iron ring set in a bed of mortar at the finished grade elevation. Cast iron grade rings shall not be used to adjust the elevation of the manhole lid, except when a street is being overlaid. Inverted rings and covers will not be permitted without the approval of the City Engineer.

Where the manhole is located in an unpaved street, alley or other area where grade has not been established, 6 to 12 inches of grade rings shall be placed between the top of cone and bottom of the ring (to allow future adjustment of the ring to grade).

Where the manhole is located in an unpaved area, a concrete collar with a #4 rebar hoop shall be cast around the ring and cover. The concrete collar shall be a continuous section with minimum dimensions of 12-inches wide and 12-inches thick.

Where a manhole is in a cultivated area, landscaped area, flood plain, or other area subject to inundation, at the discretion of the City Engineer, a watertight manhole cover shall be used. In cultivated areas, the top of the casting shall be 18 to 24-inches below the existing ground surface.

All newly constructed manholes shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulations at the time of final inspection. All ram-neck shall be trimmed flush with manhole wall.

9-3-5: REMOVALS, EXCAVATION, BACKFILLING, AND RESTORATION SPECIFICATIONS

- (A) **Description.** This section covers surface removals, excavation, backfilling, compaction, disposal of surplus material, restoration of disturbed surfaces, and all other work required for the safe and proper construction of sanitary sewers.
- (B) **Survey Line and Grade.** All construction surveying and staking shall be performed by or under supervision of an Engineer or land surveyor registered in the State of Colorado. The Contractor shall use a laser instrument to maintain and control the line and grade of all gravity flow pipelines including sanitary sewers, storm drains and irrigation lines. Check points shall be set at 50 feet, 100 feet and 200 feet from the beginning of each reach of pipe to assure that the laser is on the correct line and grade.
- (C) **Street Cut Permits.** If required, a Street Cut Permit must be obtained from the Public Works Department prior to commencing the work.
- (D) **Removal of Structures and Obstructions.** The removal of structures and obstructions shall be in accordance with subsection 9-4-3 of the Street System Standards. The Contractor shall remove surface materials and obstructions only to the widths necessary for excavation of the trench. All trees, shrubbery, fences, plantings and structures not designated for removal shall be protected or, if moved, restored to their original condition after construction is complete.

Removal of concrete curbs, gutters, sidewalks, driveways, and asphalt pavement shall be along existing joints or neatly cut lines. All vegetation, concrete, asphalt, and other refuse removed from the construction limits shall be separated from suitable topsoil and backfill material, and hauled to a disposal site secured by the

Contractor. Where the trench is in an unpaved area, clean topsoil suitable for final grading shall be stripped, stockpiled separately in approved locations, and restored to the original thickness after the trench is backfilled.

(E) **Bracing and Sheeting of Trenches.** All trenches shall be properly braced, sheeted or otherwise supported to provide safe working conditions and protection of the work, workers and adjacent property. Bracing, trench shields and sheeting shall conform to the recommendations in the Occupational Safety and Health Standards for Construction (OSHA). Unless otherwise approved, all trench support materials shall be removed in a manner that will prevent caving of the sides and movement or other damage to the pipe.

(F) **Trenches with Sloping Sides.** Where working conditions and right-of-way width permit, trenches in unimproved areas may be excavated with sloping sides in accordance with OSHA requirements. All soils shall be assumed to be OSHA Type C Soil, unless otherwise classified by a qualified soils technician. Trenching and other excavations shall not extend beyond existing easements, right-of-way or limits shown on the Construction Drawings unless otherwise approved by the property owner and the Engineer.

In streets, alleys or narrow easements, trenches shall be excavated with vertical sides, properly braced and supported, unless otherwise approved by the Engineer. Where trenches with sloping sides are permitted, the slopes shall not extend below a point 12 inches above the top pipe.

(G) **Open Excavation Limits.** The length of open trench shall be kept to a minimum and shall not exceed the length necessary to accommodate pipe laying and backfilling operations unless otherwise approved by the Engineer. The Contractor shall be responsible for covering or barricading unattended trenches and excavations as necessary for protection of the public and the work. All trenches and excavations shall be backfilled at the end of each work day, unless otherwise shown on the plans or approved by the Engineer. The end of a trench may be left open overnight if the entire perimeter of the excavation is fenced, lighted and barricaded with construction equipment and/or Jersey barriers. An open excavation, piece of equipment or other obstruction without a proper lane closure, road closure or other approved traffic control shall block no traffic lane.

(H) **Unauthorized Excavation and Pavement Removal.** Unless authorized by the Engineer, all removed pavement and excavations made beyond the lines and grades shown on the Construction Drawings shall be replaced at the Contractor's expense.

- (I) **Unstable Trench Bottom.** Where the excavation is found to consist of muck, organic matter or any other material that is determined, by the Engineer, to be unsuitable for supporting and maintaining the line and grade of the pipe, the trench shall be excavated to an additional depth as agreed upon by the Contractor and Construction Inspector/Engineer, and replaced with an approved granular stabilization material. Should the Contractor and Inspector/Engineer fail to reach an agreement as to the depth and/or method of trench foundation stabilization, the developer shall secure the services of a Geotechnical Engineer to assist in determination of an appropriate method for stabilization.
- (J) **Bedding and Shaping Trench Bottom.** Unless otherwise directed, all trenches shall be excavated to at least six (6) inches below the pipe grade and backfilled to grade with approved granular bedding material. The bedding material shall be hand shaped and graded until the trench bottom is uniform and free from rocks, bumps, and depressions. A coupling or bell hole shall be dug at each pipe joint with sufficient length, width and depth to permit assembly of the joint and provide a minimum clearance of two (2) inches between the coupling and the trench bottom. After the pipe is joined, pipe-bedding material shall be placed and tamped under each pipe joint until all voids are filled. Care shall be taken not to displace the pipe from its line and grade.
- (K) **Cutoff Walls.** Cutoff walls shall be installed along every utility line to inhibit the movement of ground water through the screened rock bedding. Cutoff walls shall be 5 to 10 feet long and consist of native material or imported material that has a permeability rate the same or less than that of the native material. Cutoff walls shall be constructed by discontinuing the installation of bedding and haunching material and installing approved native or imported material. Cutoff walls shall be installed at intervals not exceeding 200 feet on pressurized lines. On gravity flow lines, cutoff walls shall be installed on every line, 10 to 20 feet upstream of every manhole or box.
- (L) **Rock Excavation.** Rock excavation shall consist of the removal of boulders or concrete measuring one-half (1/2) cubic yard or more, hard shale, sandstone or other bed rock which, in the opinion of the Engineer, requires for its removal the continuous use of pneumatic tools or drilling and blasting. Rock excavation shall be in accordance with Section 203 of the *CDOT Standard Specifications for Road and Bridge Construction*.
- (M) **Stockpiling Excavated Material.** Excavated material shall be piled in accordance with OSHA guidelines in locations that will not endanger the Work, create traffic hazards or obstruct sidewalks and driveways. Fire hydrants, valve boxes, manholes and other utility access points shall be left unobstructed. Gutters and other watercourses shall not be obstructed unless other satisfactory provisions are made for runoff and street drainage.

All surplus material and excavated material unsuitable for backfilling shall be removed from the site and disposed of in areas secured by the Contractor.

- (N) **Dewatering Trenches.** Trenches shall be kept free of water during pipe laying operations by draining, pumping or other approved methods. The water level shall be maintained at least six (6) inches below the trench bottom throughout the placement of bedding, pipe laying, joining and backfilling operations. The dewatering shall be carried out so that it does not destroy or weaken the strength of the soil under or along the side of the trench. The City Engineer or his representative shall approve the method of disposal of trench water. Watertight plugs shall be installed in the ends of all water and sewer lines when the trench is not being dewatered.

Surface water from any source shall be prevented from entering the trench excavation.

- (O) **Backfilling Pipe and Structures.** Unless otherwise specified or approved by the Engineer, all backfill material shall be placed with moisture-density control in accordance with the typical trench detail shown on the *Standard General Utility Details*. All backfill material shall be adjusted to near 2% of the optimum moisture for non-clay soils, and at optimum moisture to +4% for clay soils, prior to its placement in the trench.

A minimum of 24 inches of compacted backfill shall be placed over the top of all polyvinyl chloride (PVC) and polyethylene (PE) pipes before vehicles or heavy equipment are allowed to pass over the pipe. Less cover may be allowed only where *flow-fill* or other approved material is used for the pipe haunching and backfill material. Flow-fill shall meet the requirements of section 9-5-10 of the Concrete Standards, unless approved by the City Engineer.

During initial backfilling, the Contractor shall take all necessary precautions to prevent movement or distortion of the pipe or structure being backfilled. Pipe haunching material shall be placed and compacted in even lifts on both sides of the conduit to six (6) inches above the top of the pipe. Above the bedding and haunching material, earth backfill material shall be placed full width in uniform layers not more than twelve (12) inches thick. Each layer shall be compacted to the required density with approved mechanical or hand tamping equipment. Hydro-hammers or other heavy compaction equipment shall not be used unless approved by the City Engineer. No hydro-hammer shall be used for compaction with less than 48 inches of cover over the pipe.

It shall be the Contractor's responsibility to make necessary excavations and to provide safe access into the excavations in accordance with OSHA Standards in order to accommodate compaction tests at all locations designated by the authorized Technician.

- (1) **Backfill Testing Requirements:** All backfill shall be frequently tested to insure that the required density is being attained. For every 400 lineal feet of trench and each branch or section of trench less than 400 feet in length, at least one compaction test shall be performed for each two-foot vertical depth of backfill material placed. The first test shall be taken approximately two feet above the top of pipe and the last test shall be at the pavement subgrade or 6 inches below the ground surface in unpaved areas. Compaction tests shall be taken at random locations along the trench and wherever poor compaction is suspected. If any portion of the backfill placed fails to meet the minimum density specified, the failing area shall be defined by additional tests, if necessary, and the material in the designated area shall be removed and replaced to the required density at the Contractor's expense.

The frequency of compaction testing may be reduced to one test for every 1000 feet of trench if full-time inspection is made during the backfilling operation by the Engineer or an independent testing laboratory and sufficient initial testing has been performed to demonstrate that the methodology being used achieves the required results. The methodology shall be verified for each soil type or trench condition encountered.

Failed compaction tests shall be immediately reported to the Inspector and the Contractor. A summary report of all compaction test results, including retests of failed tests and a test location map or other approved location format shall be submitted to the Project Engineer and to the Contractor. Compaction test results are required as a basis of acceptance of facilities by the City in accordance with subsection 9-3-7.

- (2) **Backfilling Concrete Structures:** Concrete structures shall not be backfilled until the concrete and mortar therein has attained a minimum compressive strength of 2000 psi and can sufficiently support the loads imposed by the backfill. Earth backfill shall be placed simultaneously on all sides of the structure in layers approximately twelve (12) inches thick. Each layer shall be compacted to not less than ninety-five percent (95%) of the maximum dry density determined in accordance with AASHTO T-180.

- (P) **Granular Stabilization, Bedding and Haunching Materials.** Granular materials required for stabilization of poor subgrade soils, bedding of pipe and structures, and haunching around pipe shall meet the following gradation requirements:

Sieve Size	Percent passing, by weight	
	Pipe bedding & haunching (crushed rock)	Granular Stabilization (screened or crushed rock)
2 inch	- - -	100%
1 inch	100%	- - -
No. 200	20% max.	15% max.

Crushed rock shall be the product of crushing rock and gravel. The portion of the material larger than will pass a 3/8-inch sieve shall contain at least 50 percent of particles having two or more fractured faces. Not over 5 percent shall be pieces that show no fractured faces.

- (Q) **Earth Backfill Material.** Earth backfill material shall consist of approved materials developed from project excavations or imported from another source. To be suitable for backfill, earth material shall be free from muck, frozen lumps, ashes, trash, vegetation and other debris. All excavated materials that, in the opinion of the Engineer, are unsuitable for use in the backfill shall be removed from the site and disposed of by the Contractor at his expense. The maximum size of rock or clod allowed within 6" of any plastic pipe shall be one (1) inch. The maximum size of rock or clod allowed within 6" of a rigid pipe or structure shall be three (3) inches.

- (1) *Proof Rolling:* The Engineer or Construction Inspector may require proof rolling of the compacted backfill material to test for deflection or additional consolidation. The Contractor shall furnish a rubber-tired, self-propelled vehicle for proof rolling. Acceptable proof rolling equipment includes a loaded water truck or loaded dump truck. If while proof rolling, any visible deflection or rutting is observed, additional compaction of the backfill will be required.

- (R) **Restoration of Grounds.** The cleanup and restoration of grounds shall be a continuous process from the beginning of construction to final completion of the Work. The Contractor shall keep the work site free from accumulation of debris and waste material caused by his operation. In the case of point-location work to be performed later in the construction process, such as water line tie-ins, the restoration (but not the clean up) of the area adjacent to the point-location may be delayed until the point-location work is performed.

- (1) After the pipeline is backfilled, the area shall be cleaned and restored to the original grade and condition. The cleaning and restoration shall be kept up to no greater than 500 feet behind the backfill operations.
- (2) All fences, utilities, culverts, ditches, structures, grassed areas and plantings shall be replaced and restored to a condition equal to or better than that at the beginning of construction.
- (3) The restoration of asphalt and concrete surfaces and structures may be performed at the completion of a segment of the project, unless otherwise specified. A segment is defined as one contiguous length of pipe installed.

- (S) **Restoration of Concrete and Pavement Surfaces.** The Contractor shall replace all concrete and pavement surfaces removed or damaged by his operation. All paving, aggregate base course and concrete replacement work shall be in accordance with the *Street System Standards*. Paving and/or patching for an entire project may be performed as a single operation unless otherwise specified.

Prior to paving or patching all edges that have been broken, raveled or otherwise damaged shall be recut to a neat line. Refer to subsection 9-4-3 of the *Street System Standards*.

9-3-6: SANITARY SEWER PIPELINE TESTING

- (A) **General.** All sanitary sewers shall be tested before final acceptance. The contractor shall notify the City Engineer and a pre-construction meeting shall be held to determine applicable testing requirements. The Contractor under direct control and observation of the Engineer of Record or an approved independent laboratory, and a representative of the City Engineer shall perform all testing. The Contractor shall furnish all labor, equipment, tools, water and other incidental items required to conduct the tests. Proper cross connection protection shall be used when connecting to the City water system.
- (B) **Re-testing.** If a pipeline fails to meet the test requirements, the leak or other deficiency shall be located and repaired at the Contractor's expense. After the repairs or corrections have been made, the pipeline shall be retested. Repairs and retesting shall continue until the test requirements have been met.
- (C) **Leakage Tests.** A leakage test shall be performed on all newly constructed sanitary sewers. The City will determine which test(s) will be made and the Contractor shall furnish all labor, tools and equipment necessary to conduct the test. The allowable types of tests are exfiltration of water, exfiltration of air, infiltration of water, and infiltration of air.

- (D) **Exfiltration of Water Test.** The length of pipeline to be tested shall be limited so that the pressure on the lower end of the test section does not exceed 10 feet of water column. The test section shall be sealed off from the remaining pipeline with watertight plugs inserted in the pipes. The Contractor shall fill the pipe to the test level with potable water at least 24 hours prior to conducting the test. The test level shall be at least 2 feet above the top of the pipe, in the upper manhole, or 2 feet above the ground water table, whichever is higher.

Throughout the test period of at least 1 hour, the water level shall be maintained at the test level and all water added shall be accurately measured. The exfiltration rate shall not exceed 0.15 gallon per inch of inside pipe diameter per hour per 100 feet of pipe length.

- (E) **Exfiltration of Air Test.** Air testing shall be in accordance with ASTM C-828 or ASTM F1417-92. The ends of the test section shall be sealed at the upper and lower manholes with pneumatic plugs. One of the plugs provided shall have two taps. One tap will be used for introducing air into the pipeline through suitable valves and fittings so that the input air may be regulated. The second tap shall be fitted with valves and fittings to accept a pressure gauge to monitor the internal pressure of the sewer pipe.

- (1) The pressure gauge shall meet the following minimum specifications:

Size.....4-1/2 inch diameter
Pressure range0 - 15 psi
Figure intervals1-psi increments
Smallest intervals0.1 psi
Pressure tubeBourdon tube or diaphragm

- (2) Connect the pressure gauge and air control equipment to the proper fittings and slowly apply air pressure. Pressurize the pipe line to 4.0 psig and throttle the air supply to maintain the pressure between 4.0 and 3.5 psig for at least 2 minutes in order to allow equilibrium between air temperature and pipe walls. During this time check all plugs for leakage. If any plugs are found to leak, bleed off the air, tighten the plugs and re-pressurize the pipeline. After the temperature has stabilized, allow the pressure to decrease to 3.5 psig. At 3.5 psig begin timing to determine the time required for pressure to drop to 2.5 psig. The time, in seconds, for the air pressure to decrease from 3.5 psig. to 2.5 psig shall be greater than the minimum test time shown in the following table.

Nominal Pipe Size (inches)	Time (min/100ft)	Nominal Pipe Size (inches)	Time (min/100ft)
4	0.3	24	3.6
6	0.7	27	4.2
8	1.2	30	4.8
10	1.5	33	5.4
12	1.8	36	6
15	2.1	39	6.6
18	2.4	42	7.3
21	3.0		

In areas where the ground water level is above the pipe, the hydrostatic pressure of the ground water above the pipeline shall be determined and added to all test pressures (1 ft. of water = 0.43 psi). Air testing shall not be done if the groundwater level is greater than 10 feet above the sewer line.

- (F) **Infiltration of Water Test.** If the sewer line is in an area where the water table is 2 feet or more above the pipeline, an infiltration test may be used. Infiltration tests shall be completed prior to placing new sewer lines in service. Throughout the test period of at least 1 hour, the rate of infiltration of ground water shall be accurately measured using weirs inserted in the pipeline downstream of manholes where flow is present. The infiltration rate shall not exceed 0.15 gallon per inch of inside pipe diameter per hour per 100 feet of pipe length.
- (G) **Infiltration of Air Test.** Manholes will be tested using the negative air pressure test (vacuum) in accordance with ASTM C 1244-93, or latest edition, for watertightness, and manhole will be visually inspected after backfilling. Contractor may backfill before testing with the understanding that any repairs will be made from the exterior of the manhole.
- (1) Manholes shall be vacuum tested and shall have 10 inches of mercury applied to the manhole and the time measured for the vacuum to drop from 10 inches to 9 inches of mercury. Vacuum equipment shall be approved by the City Engineer prior to its use.
 - (2) Test times for structures other than manholes will be based on the times for manholes of the nearest equivalent volume or as directed by the Engineer.
 - (3) Written verification must be furnished that the following steps are followed:
 - (a) The test method is only to be applied to precast concrete manholes.
 - (b) Stubouts, manhole boots and pipe plugs shall be secured to prevent movement while the vacuum is drawn.

(c) If a manhole fails during the test, necessary repairs shall be made and the vacuum test repeated until the manhole passes the test.

(4) Vacuum Test (ASTM C1244) for Concrete Sewer Manholes. Minimum allowable test times shall be as follows:

MINIMUM TEST TIMES FOR VARIOUS MANHOLE DIAMETERS

Depth (Ft)	Diameter (In)					
	36	48	54	60	66	72
	Time (Sec)					
8 or less	14	20	23	26	29	33
10	18	25	29	33	36	41
12	21	30	35	39	43	49
14	25	35	41	46	51	57
16	29	40	46	52	58	65
18	32	45	52	59	65	73
20	35	50	58	65	72	81

NOTES:

The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.

A vacuum of 10 inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 inches of mercury.

The manhole shall pass if the time for the vacuum reading to drop from 10 inches to 9 inches of mercury meets or exceeds the values indicated above.

If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be retested until a satisfactory test is obtained.

(H) **Alignment Testing.** All sanitary sewer lines shall be observed for correct alignment by lamping. If the line does not pass the lamping test or if something other than crushed rock was used for pipe bedding, deflection testing shall be performed on flexible pipe or appropriate repairs shall be made on rigid pipe.

(I) **Lamping Test.** Lamping will be performed on all sanitary sewer pipe by the Engineer. All lines will be flushed at least 24 hours and no more than 48 hours prior to lamping. In order to pass the lamping test, no deformations or defects shall be observed in the pipe, the full vertical height of the pipe shall be observed and seven-eighths (7/8) of the pipe circle shall be observed horizontally.

For systems where a sewer line is allowed by the City Engineer to be stubbed out for a future extension without a manhole on the end, the trench shall be backfilled up to the end of the line but the end of the pipe shall remain accessible. The line shall be lamped from the open end of the pipe to the next downstream manhole.

- (J) **Deflection Testing for Flexible Pipe.** The maximum allowable deflection of flexible pipe shall be seven and one-half percent (7.5 %) of the Base Inside Diameter. The following values from ASTM D-3034 shall apply for SDR 35 PVC sewer pipe:

Nominal Pipe Size (Inches)	Base Inside Diameter (Inches)	Mandrel Diameter (Inches)
6	5.74	5.31
8	7.665	7.09
10	9.563	8.84
12	11.361	10.51
15	13.898	12.86

The deflection test will be performed by pulling a mandrel through the pipe from manhole to manhole.

- (K) **Closed Caption Television.** The contractor shall notify the City’s Public Works Department after sewer main installations for required testing. Subsequent to sewer main installation, required testing, and prior to paving, the City shall conduct random video inspections at no expense to the Contractor on sewer mains installed in street right-of-ways. Significant deficiencies observed during lamping or random video inspection may prompt the City to require more extensive video inspection to be performed at the Contractor’s expense. The Contractor shall, at his expense, remedy all identified deficiencies to the satisfaction of the City Engineer. The Contractor shall, at his expense, camera sections of the line at the City Inspector’s discretion. All bored or micro-tunneled sewer lines shall be inspected by television at the Contractor’s expense.

9-3-7: FINAL INSPECTION AND ACCEPTANCE

- (A) **General.** The acceptance of all pipelines by the City, based on red-lined as-builts of sewer facilities is required PRIOR to paving, and passing a final inspection of the Work by the City Engineer or his representative.

- (B) **Contractor's Warranty.** The Contractor shall guarantee his work to be free from defects in materials and workmanship for a period of not less than one year, the initial Acceptance Period. At the end of the 1-year initial Acceptance period and at the written request of the Contractor, the City Engineer and the Contractor shall jointly observe the work. The City Engineer may request such tests and inspections as deemed necessary, and consistent with these specifications. Any defects in the system resulting from defective materials, poor workmanship or any other cause attributable to the contractors work shall be corrected by the contractor, to the satisfaction of the City Engineer at the Contractor's expense.
- (C) **Inspection Results Submittal and Documentation.** Submittal of satisfactory results of tests (such as pipeline pressure test, leakage tests, disinfection tests, etc.) required to be performed by the Contractor and certified by the Engineer or an approved independent laboratory. Submittal of all quality assurance test results in accordance with Table 1, Required Quality Assurance Testing, see section 9-3-1(C). Submittal of satisfactory results of required test (such as pressure test, leakage tests, etc.) **DOCUMENTATION OF TEST RESULTS SHALL BE REPORTED ON CITY-PROVIDED FORMS.**
- (D) **As-Built Drawings.** Two sets of As-Built construction drawings shall be submitted on 24" x 36" or 22" x 34" paper or vellum in accordance with the Montrose submittal standards in Chapter 9-1. An Engineer shall stamp and sign all As-Built drawings prior to submittal. As-Built drawings shall also be submitted as an electronic AutoCAD file in accordance with the Montrose submittal standards in Chapter 9-1.

9-3-8: SANITARY SEWER SYSTEM DETAILS

- SS-01 General Sewer Notes
- SS-02 Standard Manhole – Cast in Place Base
- SS-03 Standard Shallow Manhole – Cast in Place Base
- SS-04 Drop Manhole
- SS-05 Standard Cast Iron Manhole Ring and Cover
- SS-06 Typical Service “Y” Connection
- SS-07 Sewer Service Cleanout Within Right-of-Way Detail
- SS-08 Precast Manhole Base and Manhole Access Location
- SS-09 Round Sampling Manhole
- SS-10 Rectangle Sampling Manhole
- SS-11 Grinder Pump – Feature Identification
- SS-12 Grinder Pump
- SS-13 Ballast Calculations
- SS-14 750 Gallon to 1,250 Gallon Grease Interceptor
- SS-15 1,250 to 3,445 Gallon Grease Interceptor


- A. CONTRACTOR SHALL HAVE ONE SIGNED COPY OF PLANS AND A COPY OF THE CITY OF MONTROSE'S STANDARD SPECIFICATIONS AT THE JOB SITE AT ALL TIMES.
- B. ALL SEWER MAINS SHALL BE PVC SDR 35 (ASTM 3034) UNLESS OTHERWISE NOTED.
- C. ALL SEWER MAINS SHALL BE LAID TO GRADE UTILIZING A PIPE LASER.
- D. ALL SERVICE LINE CONNECTIONS TO NEW MAINS SHALL BE ACCOMPLISHED WITH FULL BODY WYBES OR TEES. TAPPING SADDLES WILL NOT BE ALLOWED.
- E. SERVICE LINE CONNECTIONS TO EXISTING NON-PVC MAINS SHALL BE ACCOMPLISHED USING "INSERTA TEES" MANUFACTURED BY FOWLER MANUFACTURING COMPANY OF HILLSBORO, OREGON. FOR EXISTING PVC MAINS, TAPPING SADDLES SHALL BE USED.
- F. NO 4 INCH SERVICES SHALL BE CONNECTED DIRECTLY INTO MANHOLES. ALL 6 INCH SERVICES SHALL BE ACCOMPLISHED INSIDE OF A MANHOLE.
- G. THE CONTRACTOR SHALL NOTIFY THE CITY INSPECTOR 48 HOURS PRIOR TO COMMENCEMENT OF CONSTRUCTION.
- H. THE CONTRACTOR IS RESPONSIBLE FOR ALL REQUIRED SEWER LINE TESTING TO BE COMPLETED IN THE PRESENCE OF THE ENGINEER OR HIS REPRESENTATIVE. PRESSURE TESTING WILL BE PERFORMED AFTER INSTALLATION OR DRY UTILITIES, AFTER ALL COMPACTION OF STREET SUBGRADE AND PRIOR TO STREET PAVING. FINAL LAMPING WILL ALSO BE ACCOMPLISHED AFTER PAVING IS COMPLETED. THESE TESTS SHALL BE THE MINIMUM BASIS OF ACCEPTANCE OF THE SEWER LINE EXTENSION.
- I. THE CONTRACTOR SHALL OBTAIN CITY OF MONTROSE STREET CUT PERMIT FOR ALL WORK WITHIN EXISTING CITY RIGHT-OF-WAY PRIOR TO CONSTRUCTION.
- J. A CLAY CUT-OFF WALL SHALL BE PLACED 10 FEET UPSTREAM FROM ALL NEW MANHOLES UNLESS OTHERWISE NOTED. THE CUT-OFF WALL SHALL EXTEND FROM 6 INCHES BELOW TO 6 INCHES ABOVE GRANULAR BACKFILL MATERIAL AND SHALL BE 2 FEET WIDE. IF NATIVE MATERIAL IS NOT SUITABLE, THE CONTRACTOR SHALL IMPORT MATERIAL APPROVED BY THE ENGINEER.
- K. SEWER SERVICE STUB OUTS SHALL BE CAPPED AND PLUGGED. STUB OUT SHALL BE MARKED WITH A 4X4 INCH POST PAINTED GREEN BURIED WITH 3 FEET ABOVE GRADE. AS-BUILT SURVEYING FOR VERTICAL GRADE OF STUB OUT REQUIRED PRIOR TO BACKFILL.
- L. RED LINE AS-BUILTS SHALL BE SUBMITTED TO THE CITY ENGINEER AT LEAST 72 HOURS PRIOR TO PAVING FOR REVIEW.

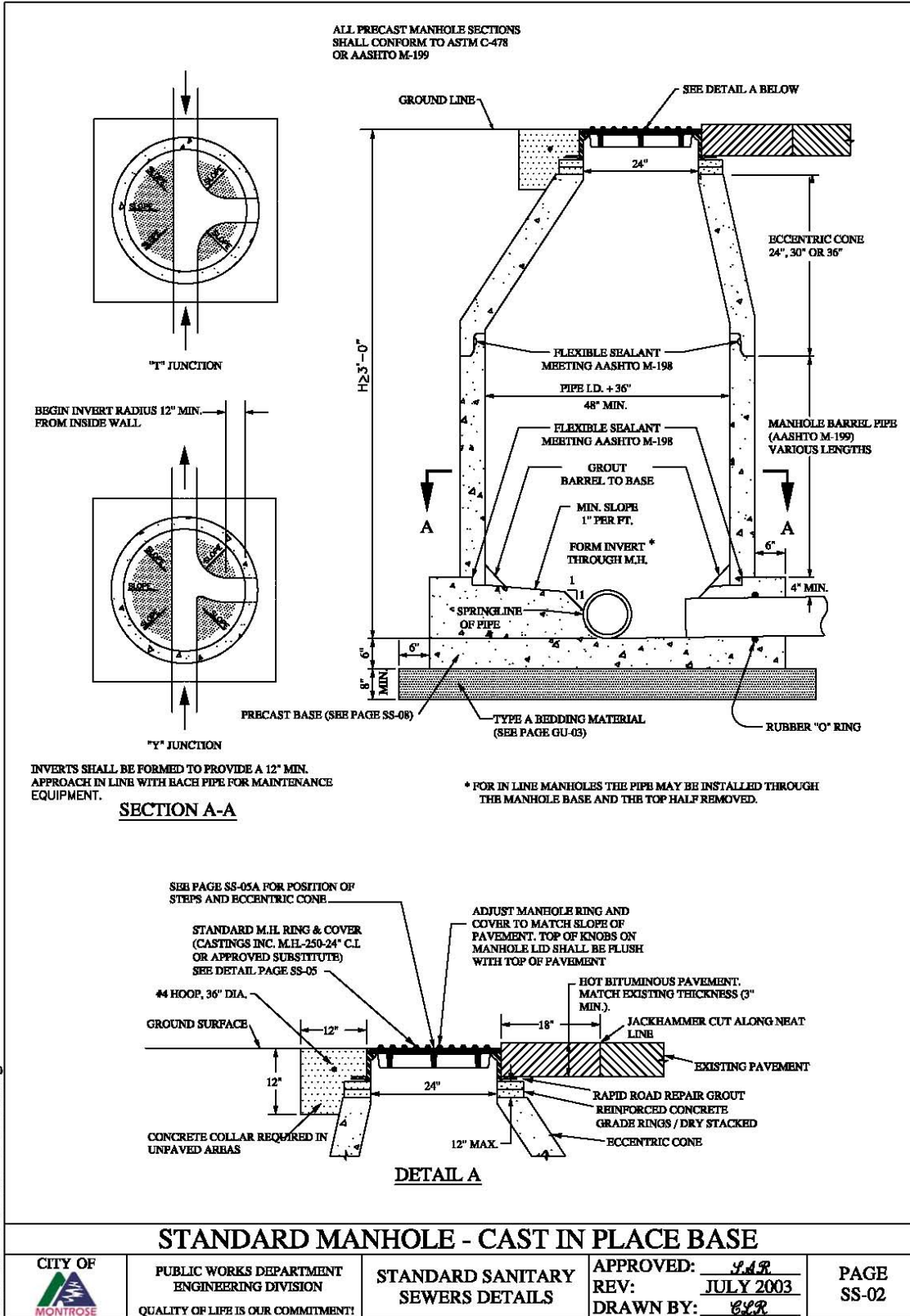
MANHOLE NOTES

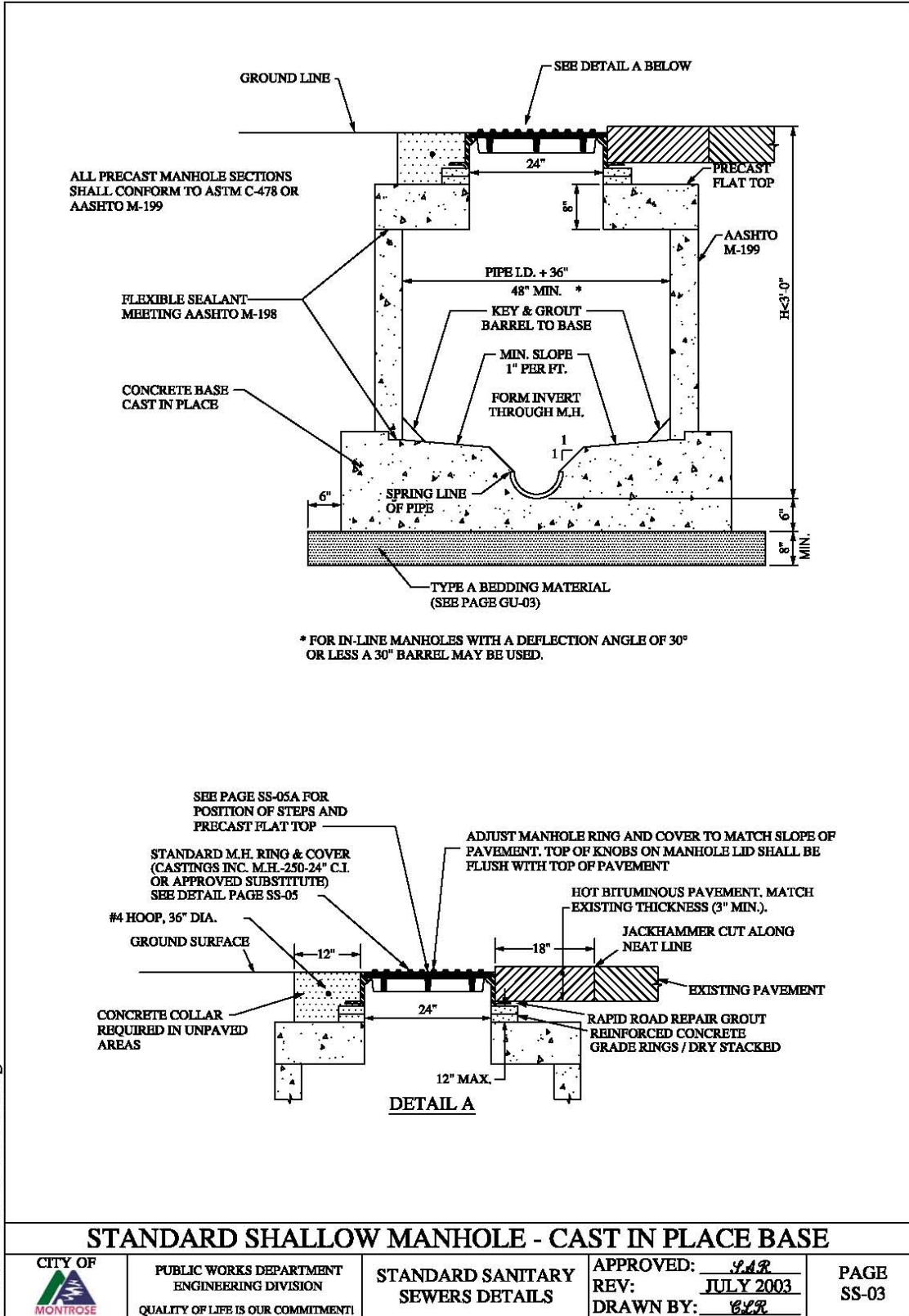
- 1. CONCRETE SHALL BE COLORADO DEPARTMENT OF TRANSPORTATION CLASS "B" (SECTION 601.02)
- 2. ALL CEMENT USED IN MORTAR, CONCRETE BASES, GRADE RINGS, RISER SECTIONS, CONES, AND FLAT TOPS, FOR SANITARY SEWER MANHOLES, SHALL BE TYPE V OR MODIFIED TYPE II PORTLAND CEMENT WITH LESS THAN 5% TRICALCIUM ALUMINATE.
- 3. MANHOLE RISER SECTIONS, CONES, FLAT TOPS, AND GRADE RINGS SHALL BE PRECAST REINFORCED CONCRETE CONFORMING TO ASTM C-478 OR AASHTO M-199.
- 4. BACKFILL AROUND MAHHOLES AND OTHER STRUCTURES SHALL BE PLACED IN 8" MAX. LIFTS AND COMPACTED TO 90% AASHTO T-180.
- 5. ALL WORK SHALL BE IN ACCORDANCE WITH APPROVED PLANS AND CITY SPECIFICATIONS.
- 6. MANHOLE CONE AND FLAT TOP SECTIONS SHALL BE POSITIONED SUCH THAT THE MANHOLE RING AND COVER IS CENTERED ON THE UPSTREAM FLOW LINE. IF THE CONE IS FURNISHED WITH STEPS, THE MANHOLE RING AND COVER WILL BE SHIFTED SO THAT THE STEPS ARE INSTALLED AT A 12" OFFSET FROM THE INLET PIPE.
- 7. IF THE MANHOLE SECTIONS ARE FURNISHED WITH STEPS THEY SHALL BE INSTALLED AT A 12" OFFSET FROM THE INLET PIPE TO FACILITATE CLEANING AND TV EQUIPMENT.
- 8. MANHOLE RING AND COVER SHALL BE SET TO FINISH GRADE USING RAPID ROAD REPAIR (OR APPROVED EQUAL) GROUT TO ADJUST RIM ELEVATION. GROUT SHALL NOT EXCEED 0.10 FT. THICKNESS. GROUT SHALL BE PLACED BETWEEN TOP OF CONCRETE GRADE RING AND RING AND COVER. STEEL PAVING RINGS ARE NOT ALLOWED FOR GRADE ADJUSTMENT UNLESS OTHERWISE APPROVED BY THE ENGINEER.
- 9. INVERTED CASTINGS WILL NOT BE ALLOWED UNLESS APPROVED BY THE ENGINEER.

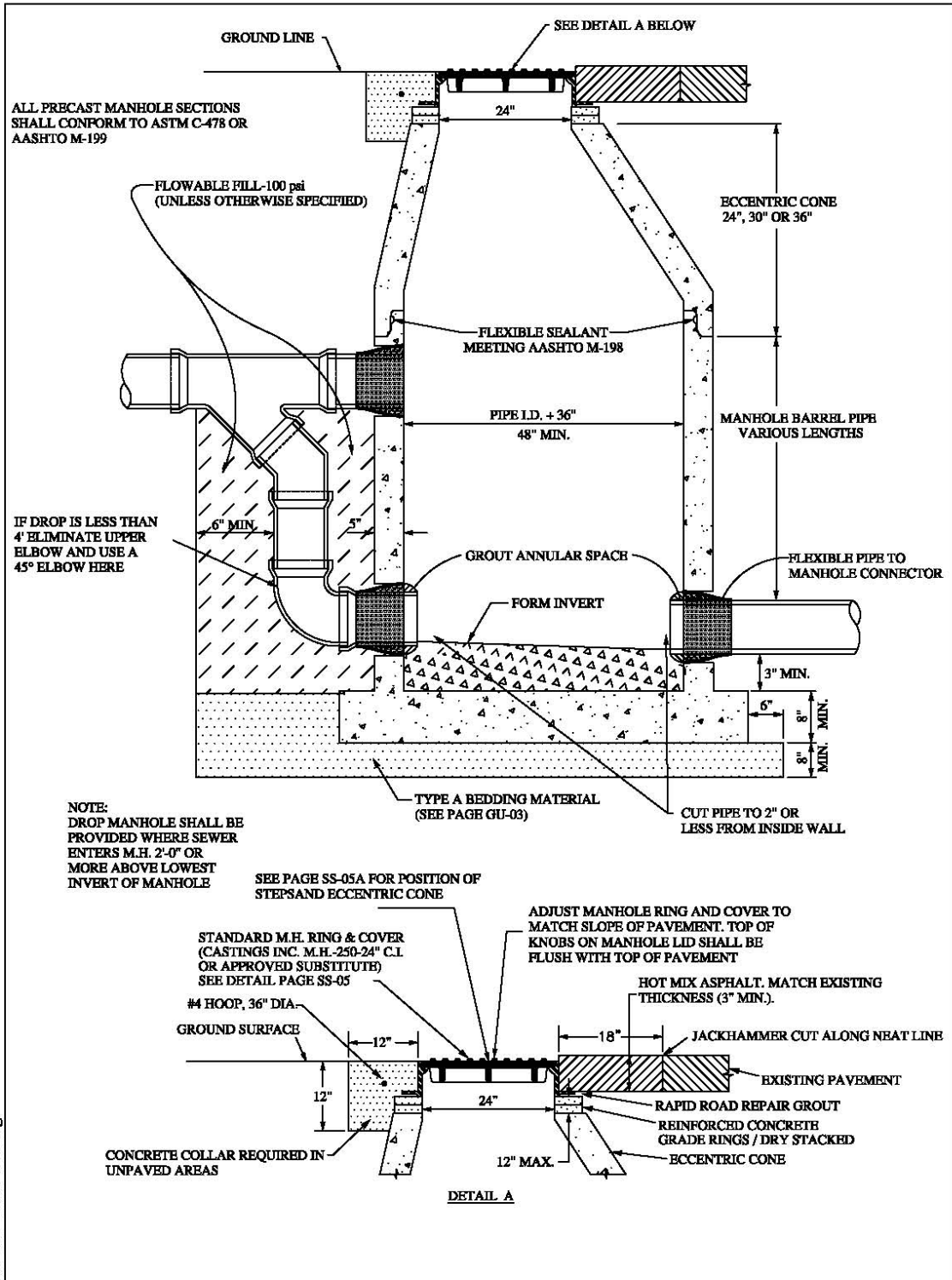
GENERAL SEWER NOTES

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 <p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION</p> <p>QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD SANITARY SEWERS DETAILS</p>	APPROVED: <u>ELR</u>	<p>PAGE SS-01</p>
			REV: <u>JULY 2003</u>	
			DRAWN BY: <u>ELR</u>	



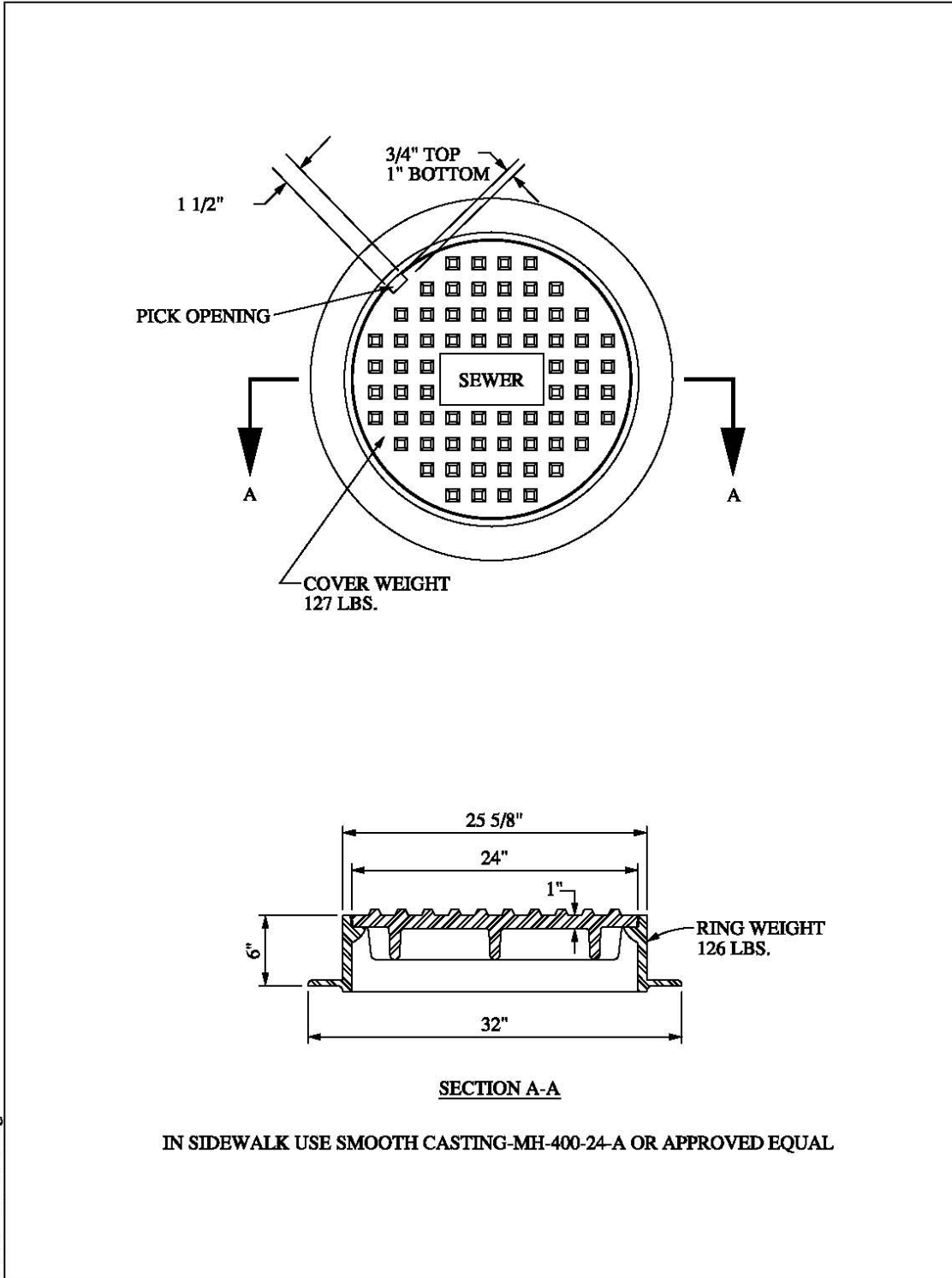




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STANDARD SHALLOW MANHOLE - CAST IN PLACE BASE

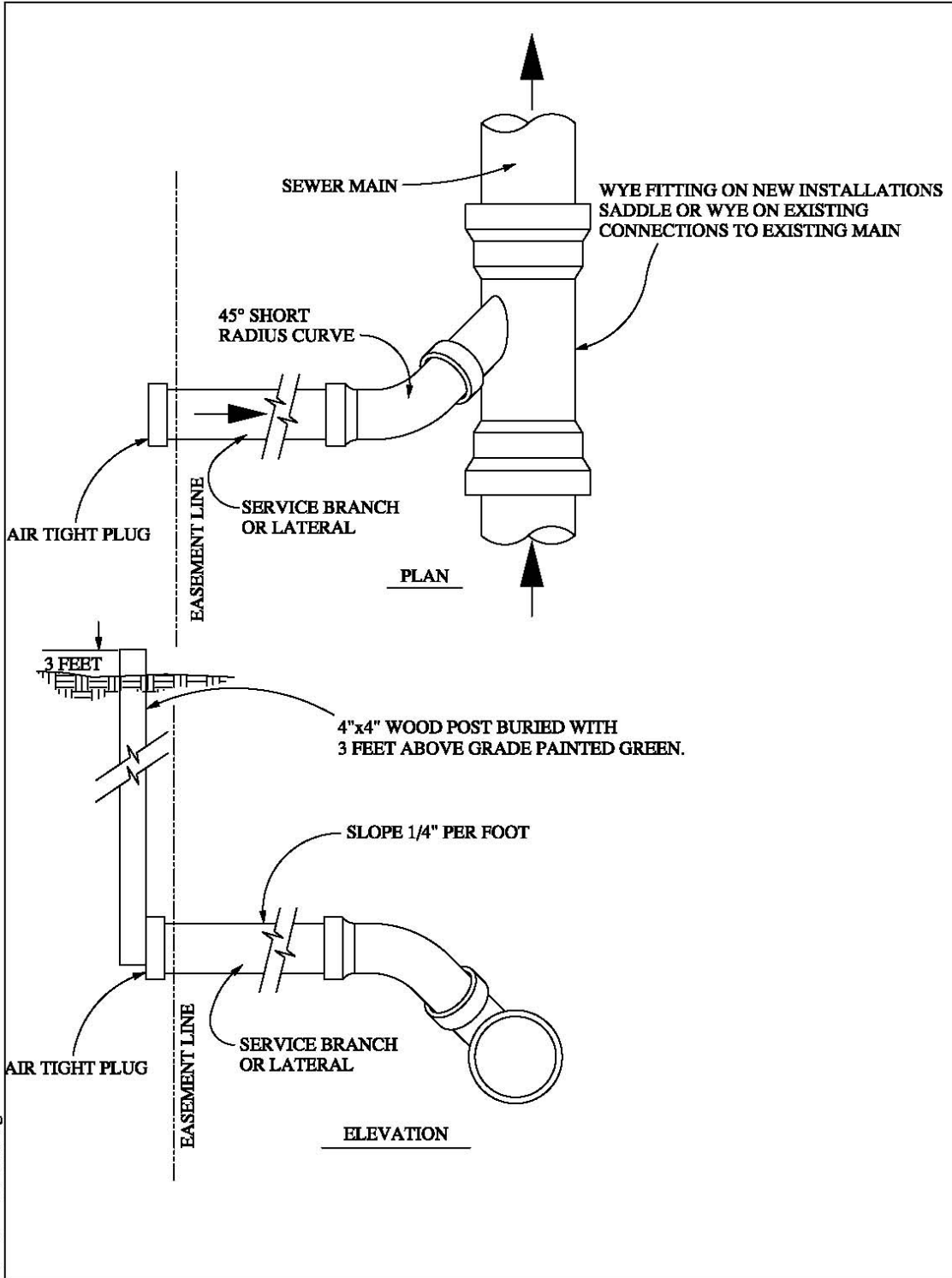
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			<p>DRAWN BY: <i>ELR</i></p>	



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STANDARD CAST IRON MANHOLE RING AND COVER

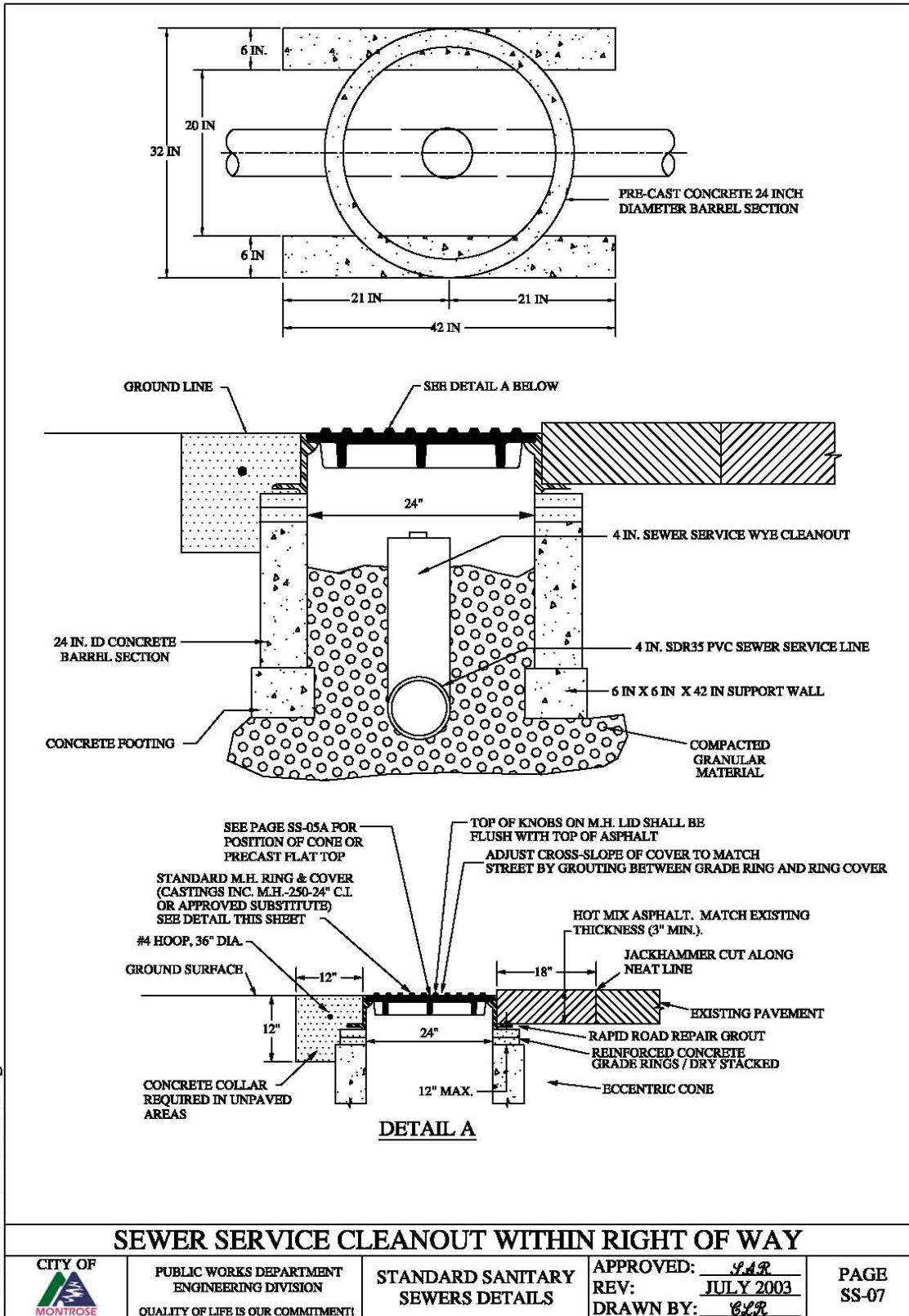
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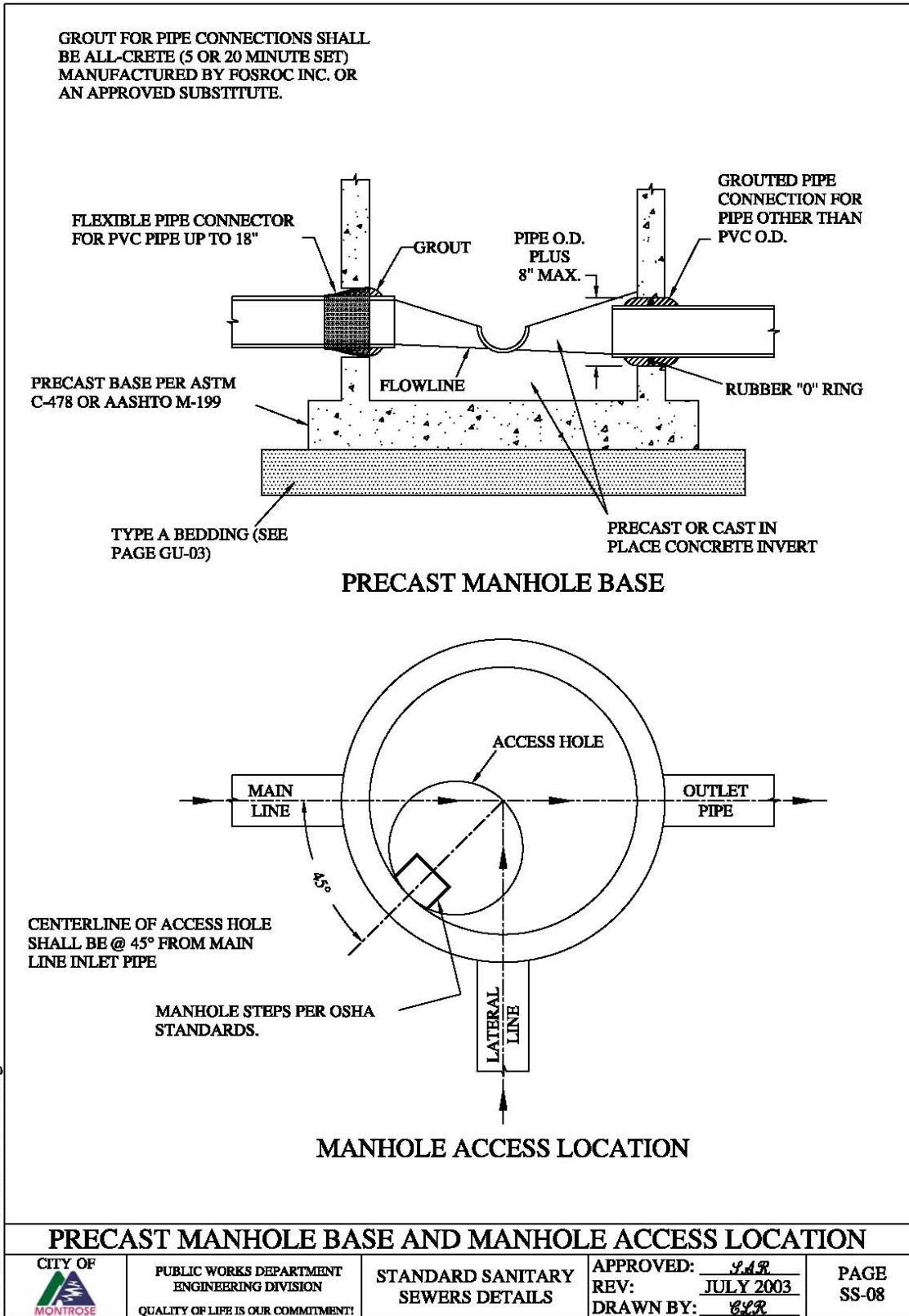


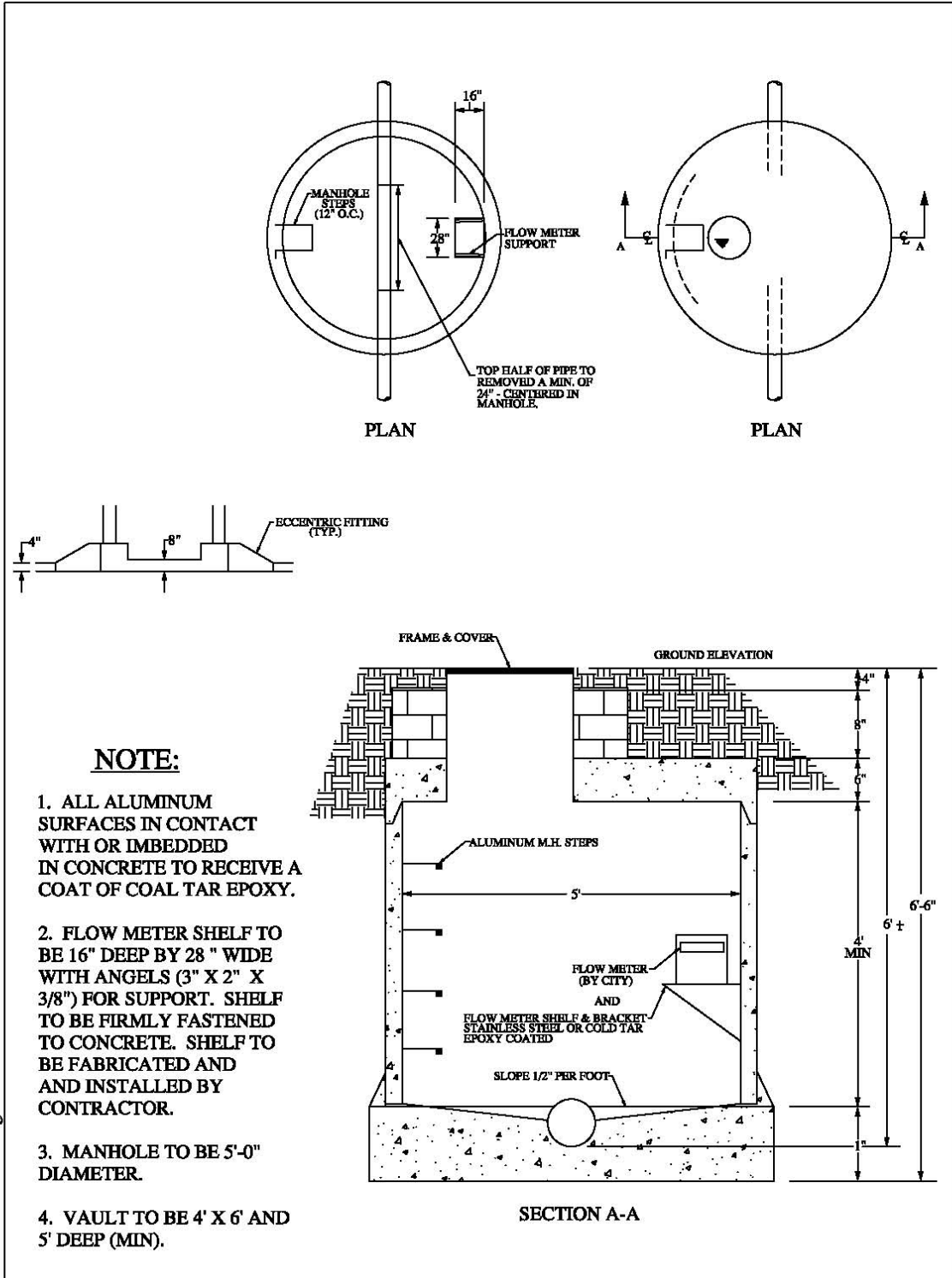
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TYPICAL SERVICE "Y" CONNECTION

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			REV: <u>JULY 2003</u>	
			DRAWN BY: <u>CLR</u>	



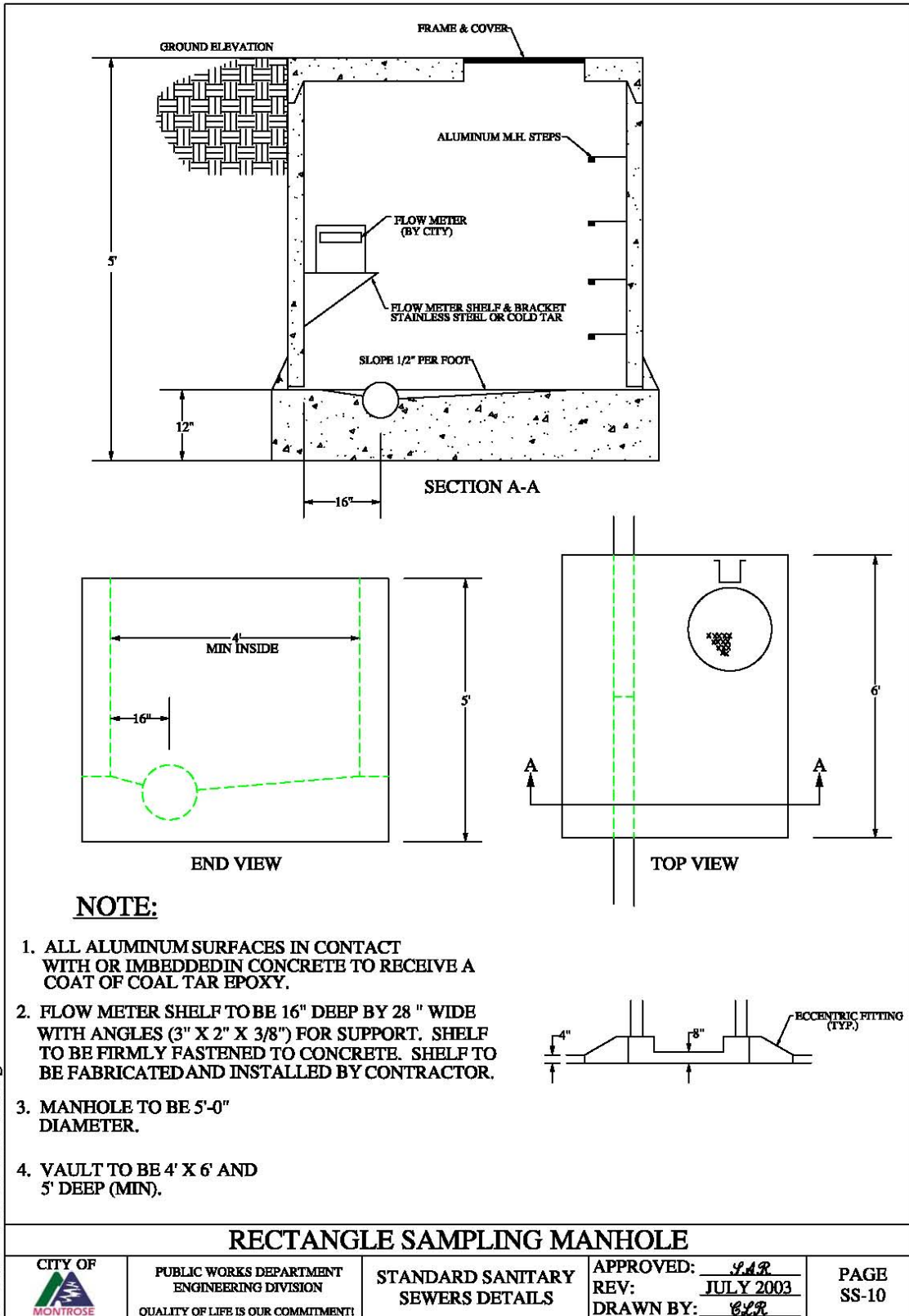




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ROUND SAMPLING MANHOLE

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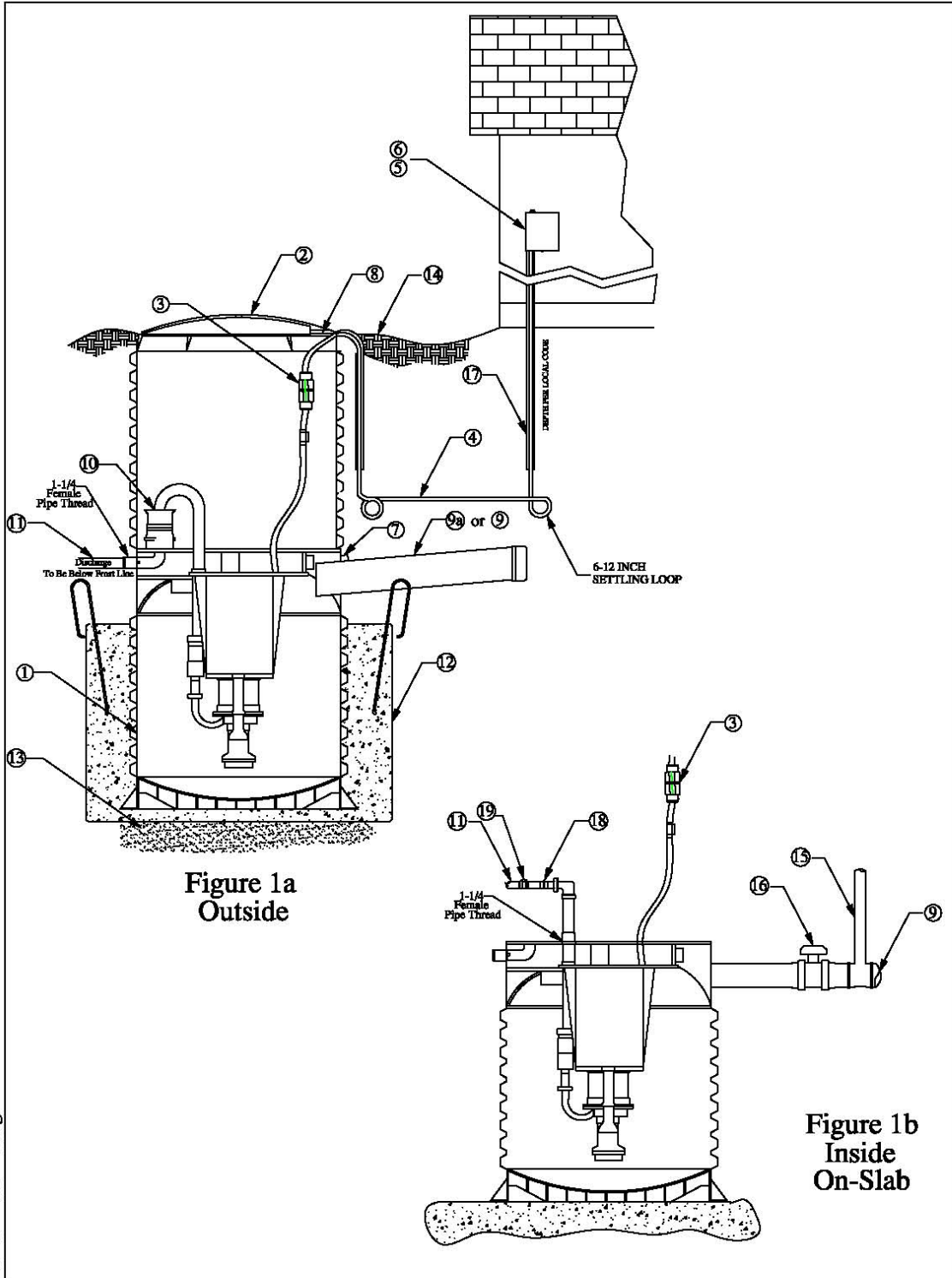
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1. **GRINDER PUMP BASIN** - High density polyethylene (HDPE).
2. **ACCESSWAY COVER** - FRP.
3. **ELECTRICAL QUICK DISCONNECT (EQD)** - Cable from pump core terminates here.
4. **POWER AND ALARM CABLE** - Circuits to be installed in accordance with local codes. (100 feet maximum length)
5. **DISCONNECT PANEL** - Rain proof (NEMA 4X) enclosure. Equipped with circuit breakers or disconnect switch. Locate according to local codes.
6. **ALARM DEVICE** - Every installation is to have an alarm device to alert the homeowner of a potential malfunction. Visual devices should be placed in very conspicuous locations.
7. **INLET** - EPDM grommet (4.5" ID). For 4.5" OD DWV pipe.
8. **WET WELL VENT** - 2.0" tank vent, supplied by factory in units with accessways.
9. **GRAVITY SERVICE LINE** - 4" DWZ, (4.5" OD). Supplied by others.
- 9a. **STUB-OUT** - 4" x 5' Long watertight stub-out, to be installed at time of burial unless the gravity service line is connected during installation. Supplied by others.
10. **DISCHARGE VALVE** - 1-1/4" Female pipe thread.
11. **DISCHARGE LINE** - 1-1/4" Nominal pipe size. Supplied by others.
12. **CONCRETE ANCHOR** - See chart 1 for specific weight for your station height. Supplied by others.
13. **BEDDING MATERIAL** - 6" minimum depth, round aggregate, (gravel). Supplied by others.
14. **FINISHED GRADE** - Grade line to be 1 to 4 inches below removable lid and slope away from the station.
15. **VENT** - Indoor installation. See section 6, Vention on page 4.
16. **VALVE** - Full ported ball valve. Recommended option, for use during service operations. Supplied by others.
17. **CONDUIT** - 1" or 1-1/4", material and burial depth as required by local code. Supplied by others.
18. **UNION** - 1-1/4", or compression type coupling. Supplied by others. (Do not use rubber sleeve and hose clamp type coupling.)
19. **VALVE** - Ball valve, must provide a full-ported 1-1/4" round passage when open. Supplied by others.
20. **REBAR** - Required to lift tank after ballast (concrete anchor) has been attached, 4 places, evenly spaced around tank.

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GRINDER PUMP- FEATURE IDENTIFICATION

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Figure 1a
Outside

Figure 1b
Inside
On-Slab

GRINDER PUMP

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BALLAST CALCULATIONS

A ballast, or concrete anchor, of proper volume and weight is required on all in-ground installations. The following explains how to arrive at the correct size ballast.

The amount of ballast needed is equal to the weight it would take to counterbalance the buoyant forces that would be present if the station were being installed in water.

Therefore:

STATION VOLUME X THE WEIGHT OF WATER PER CUBIC FOOT
(62.4 LBS/CU FT) = BOUYANT FORCES

F_{BUOYANT}

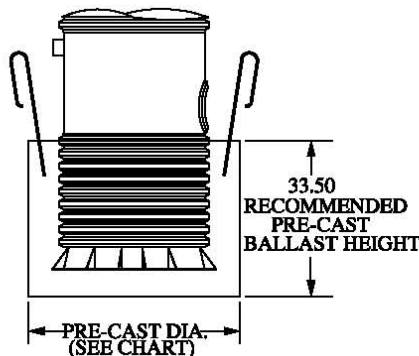
BALLAST FORCE + WEIGHT OF CONCRETE PER CUBIC FOOT IN WATER
(87.6 LBS/CU FT) = VOLUME OF CONCRETE REQUIRED

V_{CONCRETE}

VOLUME OF CONCRETE X WEIGHT OF CONCRETE PER CUBIC FOOT IN AIR =
WEIGHT OF CONCRETE REQUIRED

W_{CONCRETE} (OR FLOW FILL)

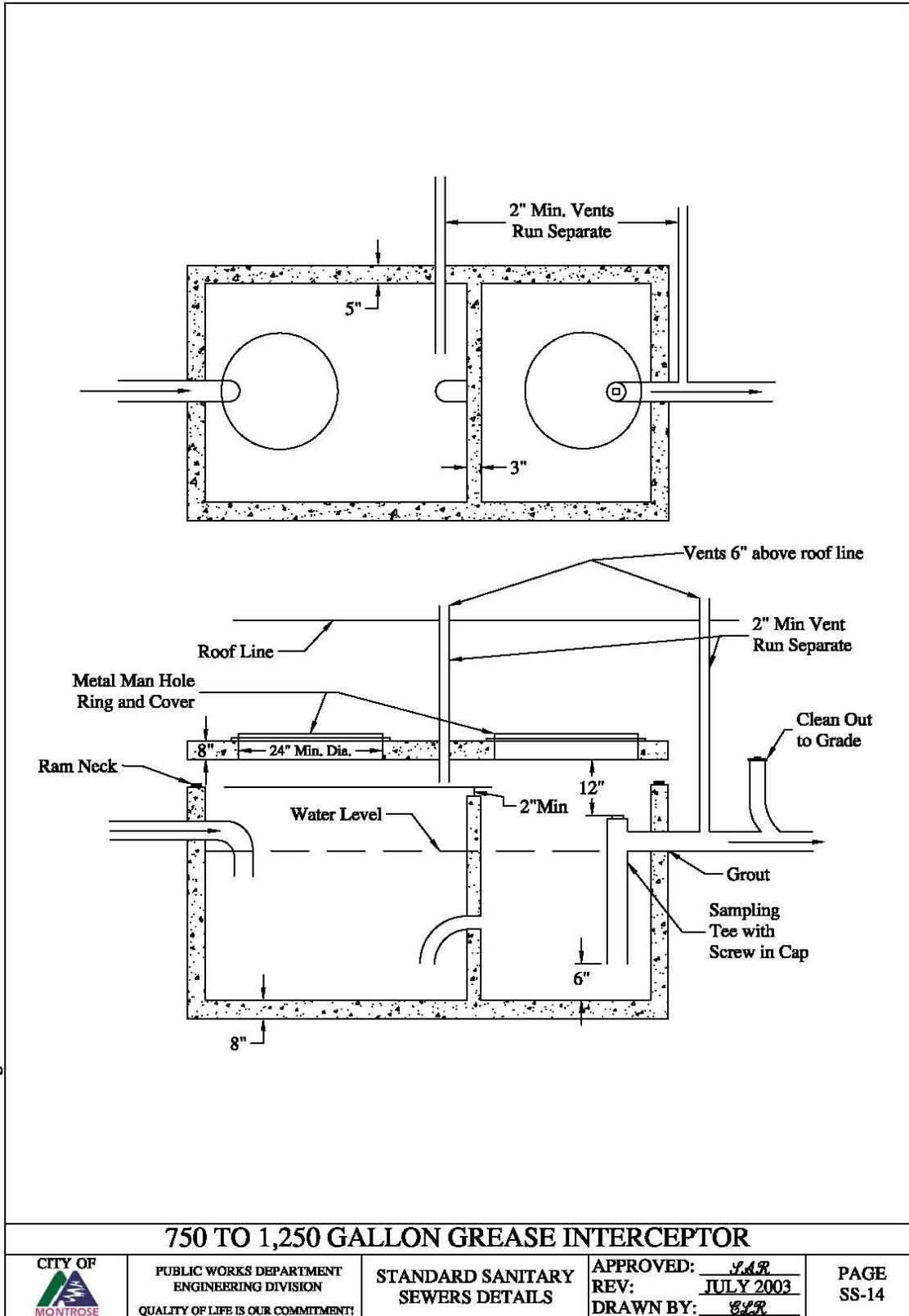
	STATION VOLUME	F _{BUOYANT}	STATION VOLUME	F _{BALLAST}	V _{CONCRETE}	BALLAST WEIGHT	BALLAST WEIGHT
2010-58	17.6 ft. ³	1098 lbs.	238 lbs.	860 lbs.	9.8 ft. ³ (.36 yd ³)	1500 lbs. (1473 lbs.)	Ø 36 in
2010-74	22.7 ft. ³	1413 lbs.	254 lbs.	1159 lbs.	13.2 ft. ³ (.36 yd ³)	2000 lbs. (1985 lbs.)	Ø 36-1/8 in
2010-93	28.6 ft. ³	1783 lbs.	270 lbs.	1513 lbs.	17.3 ft. ³ (.63 yd ³)	2600 lbs. (2590 lbs.)	Ø 42-1/2 in
2010-124	38.6 ft. ³	2407 lbs.	280 lbs.	2127 lbs.	24.3 ft. ³ (.90 yd ³)	3700 lbs. (3642 lbs.)	Ø 47-1/2 in
2010-129	40.0 ft. ³	2496 lbs.	300 lbs.	2196 lbs.	25.1 ft. ³ (.93 yd ³)	3800 lbs. (3760 lbs.)	Ø 48 in
2010-158	49.5 ft. ³	3089 lbs.	325 lbs.	2764 lbs.	31.6 ft. ³ (1.17 yd ³)	4800 lbs. (4732 lbs.)	Ø 52-1/4 in
2010-160	49.9 ft. ³	3117 lbs.	329 lbs.	2788 lbs.	31.8 ft. ³ (1.18 yd ³)	4800 lbs. (4773 lbs.)	Ø 52-1/2 in

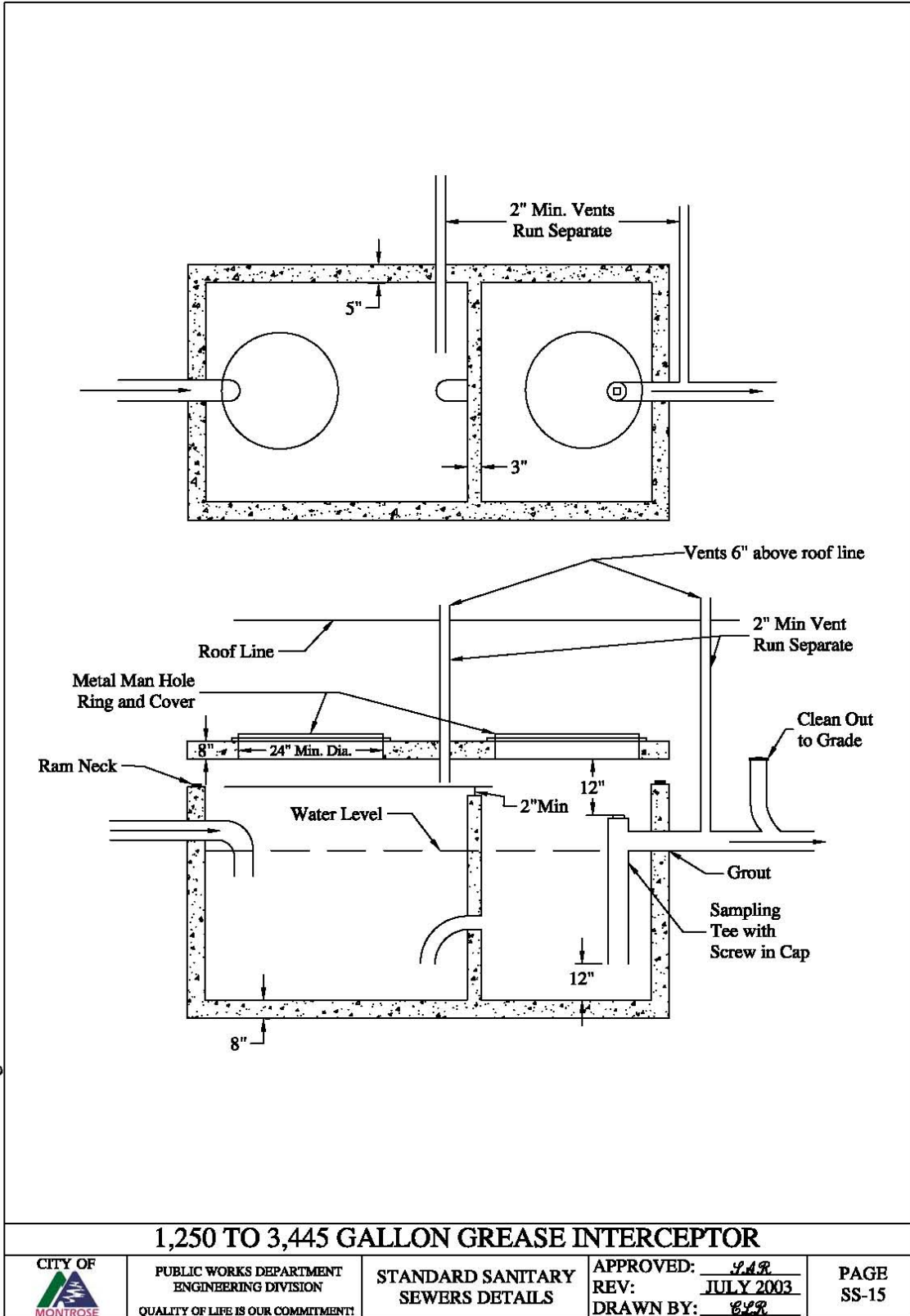


BALLAST CALCULATIONS

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 CITY OF MONTROSE	PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION	STANDARD SANITARY SEWERS DETAILS	APPROVED: <u>ELR</u>	PAGE SS-13
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			DRAWN BY: <u>ELR</u>	





CHAPTER 9-4

STREET SYSTEM STANDARDS

Sections.

- 9-4-1 **GENERAL PROVISIONS**
- 9-4-2 **STREET SYSTEM DESIGN CRITERIA**
- 9-4-3 **REMOVALS, EXCAVATION, BACKFILLING, AND RESTORATION SPECIFICATIONS**
- 9-4-4 **BASE COURSE CONSTRUCTION**
- 9-4-5 **HOT MIX ASPHALT PAVEMENT MATERIALS AND CONSTRUCTION**
- 9-4-6 **FINAL INSPECTION AND ACCEPTANCE**
- 9-4-7 **STREET DETAILS**

9-4-1: **GENERAL PROVISIONS**

- (A) **General.** The purpose of these Engineering Specifications is to provide minimum standards to safeguard life and limb, health, property and public welfare by regulating the design of, construction of, choice of materials used for, location of, maintenance and use of all public improvements and common facilities including, but not limited to, public and private streets, traffic signals and devices, public and private parking lots and appurtenances thereto. All equipment and material shall be new unless approved by the City of Montrose (City).

These Engineering Specifications represent minimum requirements and design values. Additional requirements of higher design values, commensurate with conditions, may be required by the City Engineer if, in his judgment, they are in the best interest of the City. These design guidelines have been prepared to assist Engineers preparing plans for roads and other street related public improvement projects in the City of Montrose. Variations may be permitted based solely on sound engineering practice and will be reviewed and approved by the Department of Public Works on an individual basis. Such variations must be requested in writing along with sufficient documentation supporting the request.

- (B) **CDOT Specifications.** Section 101 and Sections 200 through 717 of the Standard Specifications for Road and Bridge Construction, 1999 of the Colorado Department of Transportation, State of Colorado, (*CDOT Specifications*) as re-emphasized, supplemented or amended by the State and by these specifications shall govern all road and bridge construction work within the public right-of-way and in other areas of City jurisdiction or ownership.

9-4-2: STREET SYSTEM DESIGN CRITERIA

- (A) **Layout.** Layout of all street systems shall conform to the City subdivision requirements as defined in the Subdivision Regulations. Generally, local residential cross sections shall be used in areas where average daily traffic (ADT) is not likely to exceed one thousand (1,000) vehicles per day. Collector and arterial streets shall be constructed whenever engineered traffic analysis of the future traffic volumes indicates the need of a cross section greater than that of a local service street.

Additional ROW and/or easements may be required to satisfy other criteria contained in these Engineering Design Standards, or as deemed necessary by the City Engineer. Areas outside the ROW shall be contour graded, compacted, and sloped, as required for proper drainage, soil stability, and maintenance accessibility. Cuts and fills proposed on slopes greater than three (3) horizontal to one (1) vertical shall require supporting calculations done by a qualified soils Engineer based on a soils analysis.

- (B) **Design Element Coordination.** Horizontal and vertical alignment continuity shall be provided between new and existing streets to achieve safe and aesthetically pleasing transitions. Sufficient data on existing infrastructure shall be depicted on plans, and limits of construction shall be designated to assure that the desired continuity is achieved. Drainage and utility facilities are to comply with all applicable sections of these Engineering Design Standards and are to be fully coordinated with the street design and proposed construction.
- (C) **Traffic Impact Study.** All requests for subdivision, zoning and other site developments shall provide a Traffic Impact Study using the Institute of Traffic Engineers (I.T.E.) informational manual, as required by the City of Montrose Subdivision Regulations or requested by the City Engineer, in a form specified by the City Engineer.

(D) **Driveway Construction Regulations.** Every driveway hereafter constructed, reconstructed or altered, in the City right-of-way, shall conform to the following regulations.

- (1) No driveway shall be so located as to create a hazard to pedestrians, motorists, or to invite or compel illegal or unsafe traffic movements.
- (2) Unless otherwise approved by the City Engineer, all driveways shall be constructed within lines at right angles to the curb or street line.
- (3) No driveway shall be constructed in such a manner as to create a hazard to any existing street lighting standard, utility pole, traffic regulating device or fire hydrant. The cost of relocating any such street structure when necessary to do so shall be borne by the abutting property owner. Relocation of any street structure shall be performed only by or through the person holding authority for the particular structure involved.
- (4) No construction, alteration or repair shall be permitted for any driveway which can be used only as a parking space or which provides access only to the area between the street roadway and private property.
- (5) All driveways shall be so constructed that they shall not interfere with the drainage system of the street.
- (6) Where curbs exist, or are required, driveways shall be paved for their full width from the back of curb to the property line.
- (7) Where a driveway crosses a sidewalk, the sidewalk thickness shall be increased to a minimum of 6 inches of concrete.
- (8) A driveway or curb cut on a corner lot shall be set back a minimum of 10 feet from the property line at the corner or shall be a minimum of 20 feet from the cross street curb line whichever is greater.
- (9) No property shall be allowed more than one driveway on any particular street (no looped driveways).
- (10) The following minimum widths are permitted for driveways:

ZONING DISTRICT	WIDTH OF DRIVEWAYS
Single Family	12'
Multiple Family	24'
Commercial & Industrial	24'

- (11) Where a water meter pit is located in a concrete or paved driveway, a 4' x 4' concrete square with expansion joint shall be provided and a traffic load bearing lid and ring shall be installed.
- (12) No curb cuts shall be allowed on a State Highway except with written permission of the Colorado Department of Transportation.
- (13) Where curbs do not exist and a driveway crosses a drainage ditch, a culvert shall be installed by the property owner at a diameter sized according to the ditch capacity, but in no case less than 12 inches. The minimum length of any culvert shall be 5 feet greater than the driveway width or 20 feet whichever is greater. Culvert installation shall include flared end sections with geotextile beneath riprap to prevent erosion.
- (14) Any deviation from these standards shall be allowed only by special written permission from the City Engineer.

(E) **Curb Cuts for Recessed Diagonal Parking.**

- (1) No portion of parked car shall extend on to sidewalk.
- (2) Flow line of gutter to be maintained.
- (3) Rear portion of parked car shall not extend more than 6 feet from original curb line where parallel parking was in effect.
- (4) Not allowed on a State Highway or City Arterial Street.
- (5) Must comply with *Model Traffic Code* for Colorado Municipalities, as adopted by the City, which includes the following:
 - (a) No parking within 5 feet of public or private driveway.
 - (b) No parking within 15 feet of a fire hydrant.
 - (c) No parking within 20 feet of a crosswalk at an intersection.
 - (d) No parking within 30 feet of flashing beacon, stop sign, yield sign or traffic control signal.
 - (e) No parking within 50 feet of railroad crossing.
- (6) Design, location, and construction are subject to the approval of the City Engineer.
- (7) No construction or design expense shall be borne by the City.

- (8) It will be understood that completed parking area is for use of the general public and not solely for the private use of the person requesting it.

(F) **Subgrade Investigation and Pavement Design Report.** This report shall be prepared by or under the supervision of and signed by an Engineer and shall include the following information.

- (1) Vicinity map to locate the investigated area.
- (2) Scaled drawings showing the location of soil borings.
- (3) Scaled drawings showing the estimated extent of subgrade soil types and ESAL for each street.
- (4) Pavement design alternatives for each street on a scaled drawing.
- (5) Tabular listing of sample designation, sample depth, Group Number, Liquid Limit, Plasticity Index, percent passing the No.200 sieve, Group Index, Unified and AASHTO Classification, and soil description.
- (6) Proctor Compaction Curves.
- (7) R-value test results of each soil type used in the design.
- (8) Pavement design nomographs (per AASHTO Guide for Design of Pavement Structures, 1993) to show Soil Support - ESAL -SN.
- (9) Design calculations.
- (10) A narrative describing potential subgrade soil problems including, but not limited to, heave or settlement prone soils, frost susceptible soils, ground water, drainage considerations (surface and subsurface), cold weather construction (if appropriate), and other factors, properties, or fill areas which could affect the design or performance of the pavement system.
- (11) Recommendations to alleviate or mitigate the impact of problems discussed above.

(G) **Quality Control and Quality Assurance.**

- (1) **Quality Control.** The Contractor is responsible for quality control of all work performed and shall implement whatever procedures, methods, testing, surveying, and supervision that is required in order to insure that the work conforms to the approved plans and Street System Standards.

The Contractor is responsible for submission of HMA quality control testing documentation to verify that the mix design for the work performed conforms to the Standards at frequencies for **Hot Mix Asphalt (HMA)** as shown in **Table 1**.

- (2) **Quality Assurance.** The developer, owner or entity responsible for administering the construction of public facilities shall provide a quality assurance program. This program shall include systematic inspection and testing of the work and materials during construction to assure the owner and the City that the Contractor is providing work that is in conformance with the City-approved plans and specifications.

Initial testing shall be performed at the beginning of each construction phase in order to identify and correct any non-compliant work.

A minimum of one test will be required for any portion of material less than that shown in the "Minimum Test Frequency" column on **Table 1** below.

All failing tests shall be re-tested after the material has been reworked, modified or adjusted by the Contractor. The Contractor will be required to remove and replace any work or materials that do not meet test requirements or specifications to the satisfaction of the City Engineer.

TABLE 1 – REQUIRED QUALITY ASSURANCE (QA) / *QUALITY CONTROL (QC)* TESTING

TEST SPECIFICATION TEST REQUIRED	TEST PROCEDURE TOLERANCE	FREQUENCY	
		PART TIME INSPECTION	FULL TIME INSPECTION
Compaction of subgrade under curbs, gutters, and sidewalks.	AASHTO T 99 95% minimum	1 per 200 LF	1 per 400 LF
Compaction of subgrade and embankment under roadways.	AASHTO T 99	1 per 400 SY	1 per 600 SY
Compaction of agg. base course under concrete curbs, gutters, and/or sidewalks,	AASHTO T 180 95% minimum	1 per 200 LF	1 per 400 LF
Compaction agg. base course under fillets and drainage pans	AASHTO T 180 95% minimum	1 per fillet; 1 per 50 LF pan	1 per fillet 1 per 100 LF pan
Compaction of aggregate base course materials under roadways.	AASHTO T 180 95% minimum	1 per 400 SY	1 per 600 SY
Compaction of Structure Backfill	AASHTO T 180 95% minimum	1 for each 2 ft. of vertical depth per 100 LF of structure perimeter	
Gradation of aggregate base course (<i>QC</i>)	CDOT Table 703-2	1 per 5000 Ton	1 per 5000 Ton
HMA *			
Asphalt Content (<i>QC</i>)	CP41 method A or E, or CPL 5120	1 per 1000 Ton 1 per day min.	1 per 1000 Ton 1 per Day min.
Gradation of aggregate (<i>QC</i>)	CP31 CDOT Table 703-3	1 per 1000 Ton	1 per 1000 Ton
Air Voids (Pa) (<i>QC</i>)	AASHTO T 269 2.8% to 5.2%	1 per 1000 Ton	1 per 1000 Ton
Voids in Mineral Aggregate (VMA) (<i>QC</i>)	CP48 See Table 5	1 per 30,000 Ton	1 per 30,000 Ton
Percent Relative Compaction (<i>QC</i>)	CP81 92% to 96%	1 per 500 SY	1 per 800 SY

TABLE 1 continued

TEST SPECIFICATION TEST REQUIRED	TEST PROCEDURE/ TOLERANCE	FREQUENCY	
		PART TIME INSPECTION	FULL TIME INSPECTION
<u>CONCRETE TESTS *</u>			
Compressive Strength (4 cylinders per set) (QC)	ASTM C 31 3000 psi min and C 39 in 28 days	1 set/100 CY	1 set/day/500 CY
Air Content (QC)	ASTM C231, 5-8%	1 per 100CY	1/day/500 CY
Slump (QC)	ASTM C 143 4" maximum	1 per 100CY	1/day/500 CY
CP= Colorado Procedure (CDOT) Field Materials Manual			
* The job mix formulas for HMA and Portland Cement concrete shall be submitted in typed form by the Contractor to the City Engineer at least 10 days prior to the start of paving or concrete placement.			
Part Time Inspection. Where the Engineer or representative of the Engineer is on the project for periodic observation, documentation, and/or testing of the project construction, in an as needed capacity			
Full Time Inspection. Where the Engineer or representative of the Engineer is on the project for continuous observation, documentation and/or testing during the hours of project construction.			

9-4-3: REMOVALS, EXCAVATION, BACKFILLING, AND RESTORATION SPECIFICATIONS

- (A) **General.** This section covers surface removals, excavation, backfilling, compaction, disposal of surplus material, restoration of disturbed surfaces, and all other work required for the safe and proper road construction.
- (B) **Concrete Removal.** Concrete pavement shall be cut vertically along pre-marked lines, unless otherwise specified. The depth of the saw cut shall be to the full depth of the concrete section.
- (C) **HMA Pavement Removal.** HMA pavement designated to be cut for removal, where new HMA pavement will be placed against the cut face, shall be wheel cut, saw cut, or cut with a jack hammer along a neat line. HMA pavement designated for removal, where concrete pavement will be placed against the cut face, shall be saw cut along a straight line with a vertical face. Cut faces of concrete and HMA pavement shall be protected from damage until the new pavement is placed against them.

18-Mar-04

- (D) **Excavation and Backfill of Structures.** Flow fill shall be used to backfill structures under all paved surfaces. It may be used to backfill utility trenches, manholes and other structures and excavations in unpaved areas. Flow-fill shall not be placed around the bottom half of pipes or structures that could be displaced or damaged by the buoyant forces of the flowable fill material. Pipes shall be backfilled with an approved material to twelve (12) inches above pipe or structure and compacted to 90% compaction modified proctor.

Flow-fill shall meet the requirements of section 9-5-10 of the *Concrete Standards* unless a deviation is approved, in writing, by the City Engineer. The City Engineer may require that a sample of the proposed flow-fill mix be prepared, tested and/or placed in the backfill to demonstrate its performance prior to approval of the mix. Flow-fill shall be placed to the depth indicated on the plans or as directed by the Engineer. Bleed water shall be drained off or otherwise removed from the surface of the flow-fill after it has been placed.

Excavation and backfill for the installation of all pipe, manholes, valves, vaults and other structures and appurtenances shall be in accordance with Section 9-2-5 of the *Water Distribution System Standards* and Section 9-3-5 of the *Sanitary Sewer System Standards*.

- (E) **Topsoil Placement.** Topsoil shall consist of free draining friable sandy loam; free from roots, rocks larger than 3/8-inches, subsoil, debris, brush weeds, heavy clay, hard clods, toxic substances or other material which would be detrimental to its use on the project.

Wetland topsoil material shall consist of moist, organic soil, including any existing wetland vegetation and seeds to be excavated from areas shown on the plans or as directed.

- (F) **Dust Control.** The Contractor shall furnish and apply a dust palliative on portions of the roadway, haul roads and other locations as necessary or as directed to prevent air borne dust. This shall include prevention of dust generated from the Contractor's operations and from windy weather conditions. Dust abatement shall be provided, as needed, throughout the construction period included nights, weekends and holidays.

- (G) **Subgrade Stabilization.** Subgrade stabilization shall be used to replace wet or otherwise unstable ground conditions below the normal subgrade elevation. Subgrade stabilization shall include excavation of unsuitable material and the furnishing, placing and compaction of aggregate base course (class 2) to the depth and limits determined by the Engineer, and approved by the City Engineer.

9-4-4: BASE COURSE CONSTRUCTION

(A) **General.** Materials shall be placed on an approved subgrade, which has been proof rolled within the past twenty-four hours and found to be stable and non-yielding. Should weather conditions change, such as freezing, precipitation, etc., aggregate base materials shall not be placed until the subgrade is re-approved by the City Engineer.

- (1) The required thickness of the base course may be reduced, subject to the approval of the City Engineer, by increasing the depth of HMA at the rate of 2 inches of aggregate base course to 1 inch of HMA or appropriate depths based on strength coefficients.
- (2) If the required compacted thickness exceeds 6 inches, the base course shall be constructed in two or more lifts of equal thickness. The maximum thickness of any lift to be compacted shall not exceed 6 inches.
- (3) The minimum depth of base course on streets and alleys shall be 6 inches. Class 5 and 6 material shall be classified as base course. Class 5 and Class 6 material shall have a minimum “R” value of 70.
- (4) Class 2 material shall be classified as subbase course and used only when the base requirement is greater than 6 inches. Class 2 material shall have a minimum “R” value of 60.

(B) **Base Course Placement.** The base course material shall be placed on the previously prepared subgrade at the locations and in the proper quantities to conform to the typical cross sections as shown on the plans. Placing and spreading shall be done by means of a spreader machine, moving vehicle, motor grader, or by other approved equipment methods. The material shall be placed without segregation. Any segregated areas shall be removed and replaced with uniformly graded material at the Contractor's expense.

The base material may be placed in lifts of up to six (6) inches, providing that after compaction, uniform density is obtained throughout the entire depth of the lift. If the required depth exceeds six (6) inches, it shall be placed in two (2) or more lifts of approximate equal thickness. If uniform density cannot be obtained by six (6) inch lifts, the maximum lift shall not exceed four (4) inches in final thickness.

Base material shall not be placed on a foundation that is soft or spongy or one that is covered by ice or snow. Base material shall not be placed on a dry or dusty foundation where the existing condition would cause rapid dissipation of moisture from the base material and hinder or preclude its proper compaction. Such dry foundations shall have water applied to them and shall be reworked or re-compacted. Foundations that are soft or spongy shall be evaluated on a case-by-case basis as to the most appropriate measure to insure a stable foundation.

Care shall be exercised in the hauling and placing of base course so as to avoid segregation of the course and fine materials. The base course material shall be placed on the previously prepared and approved subgrade in sufficient quantity to conform to the thickness specified on the approved plan and profile. The material shall be mixed and watered to obtain a uniform mixture at optimum moisture.

(C) **Compaction.** Rolling shall be continuous until the base material has been compacted thoroughly in accordance with Section 304 of the CDOT Standard Specifications. Water shall be uniformly applied as needed during compaction to obtain optimum moisture content and to aid in consolidation. The surface of each lift shall be maintained during the compaction operations in such a manner that a uniform texture is produced and the aggregates are firmly placed.

(D) **Optimum Moisture Content.**

(1) Non-clay material shall be placed and compacted near optimum moisture ($\pm 2\%$). The compaction shall be continued until the base course has a density of not less than 95 percent of its Modified Proctor near optimum moisture.

(2) For clay soils, the material shall be placed and compacted at optimum moisture content up to + 4%. The compaction shall be continued until the base course has a density of not less than 95 percent of its Modified Proctor at optimum moisture.

(3) At least twenty (20) percent of the tests shall be taken within one (1) foot of a manhole or valve box.

(4) Nuclear testing equipment and methods are acceptable when performed by an approved certified testing laboratory and when performed in accordance with the requirements of ASTM D-2922 and ASTM D-3017.

(E) **Final Proof-Rolling.** The finished base course surface shall be smooth and free of ruts and irregularities, and shall be true to grade and crown as shown on the plans. The base course shall be maintained in this condition by watering, drying, rolling, or blading until the surfacing is placed.

After the base course has been compacted, tested and found to meet specifications, the entire base shall be proof-rolled with a heavily loaded vehicle with the Engineer of Record for onsite observation. The vehicle must have a certified loaded GVW of fifty thousand (50,000) pounds with a loaded single axle weight of at least eighteen thousand (18,000) pounds and a tire pressure of ninety (90) psi. Subbase which is pumping or deforming must be reworked, replaced or otherwise modified to form a smooth, stable, non-yielding base for subsequent paving lifts. The City Engineer shall be notified at least forty-eight (48) hours before final proof rolling.

- (F) **Base Course Approval.** The results of field density tests and proof rolling shall be submitted and reviewed by the City Engineer. Provided all tests are acceptable, compaction shall be approved for the placement of the HMA. Should testing indicate unsatisfactory work, the necessary reworking, compaction or replacement shall be required prior to continuation of the paving process. The approval is valid for twenty-four (24) hours. Changes in weather, such as freezing or precipitation, shall require re-approval of the base course.

9-4-5: HMA PAVEMENT MATERIALS AND CONSTRUCTION

- (A) **General.** This work consists of one or more lifts of bituminous mixture constructed on a prepared foundation in accordance with these Street System Standards. The placement of hot HMA shall conform to the lines, grades, thickness and typical cross sections shown on the plans or established. Each lift shall be compacted to the required density and approved before placement of the next lift.

HMA for patching consists of those quantities required for the placement of unstable corrugated areas in the existing pavement, pipe trenches, areas removed for curb and gutter forms, areas between the curb and gutter or sidewalk and the existing paved parking lots, and areas designated on the plans.

- (B) **Aggregates.** Aggregates shall be of uniform quality, clean, hard, durable particles of crushed stone, crushed gravel, natural gravel, or crushed slag free from clay balls, vegetable matter, or other deleterious materials meeting the requirements in Table 2 below. Aggregates meeting the requirements of Table 2 shall be used to develop the Job Mix Formula and the HMA mixture. The aggregate should be composed of angular, coarse textured, cube shaped particles. Excess of fine material shall be wasted before crushing. Sand may be used to obtain gradation of the blended aggregate mixture but should not exceed more than 15%. If the percent aggregate passing the #4 sieve is greater than 10% by weight of the individual aggregate sample, Plasticity will be determined in accordance with AASHTO T 90.

TABLE 2 - AGGREGATE PROPERTIES			
Property	Test Procedure	Coarse Retained on #4 Sieve	Fine Passing the #4 Sieve
Fine Aggregate Angularity Traffic Level Low, Moderate Trails and Pathways	CP-L5113 Method A		40% Minimum
Traffic Level 3 to 5 Moderate, High, Parking Lots			45% Minimum
Fractures Faces (minimum 2)	CP-45	80% Minimum	
LA Abrasion	AASHTO T 96	45% Minimum	
Flat and Elongated Places	AASHTO M 283	10% Maximum	
Sodium Sulfate Soundness	AASHTO T 104	12% Max Combined Coarse and Fine	
Adherent Coating (Dry Sieve)	ASTM D 5711	0.5 %	45% Minimum
Sand Equivalent	AASHTO T 176		45% Minimum

- (1) Sources of Aggregates. Sources of aggregates shall be designated by the contractor with the submittal of the job mix formula
- (2) Gradation. The gradation of aggregates used in the mixture shall meet the criteria shown in Table 3, the Aggregate Master Range Table, and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be well graded from coarse to fine. The nominal size aggregate used in the HMA mixture shall not be more than one-third (1/3) the thickness of the HMA lift being constructed.

TABLE 3: AGGREGATE MASTER RANGE TABLE			
Sieve Size	Percent by Weight Passing Square Mesh Sieves		
	Grading S	Grading SG	Grading SX
1 1/2"		100	
1"	100	90 - 100	
3/4"	90 - 100		100
1/2"			90 - 100
3/8"			
#4			
#8	23 - 49	19 - 45	28 - 58
#30			
#200	2 - 8	1 - 7	2 - 10

- (C) **HMA Material.** Binder (asphaltic cement) shall be from an approved source and shall meet the requirements listed in Table 702.2 *CDOT Standard Specifications for Road and Bridge Construction*. Based on climatic conditions and reliability, the binder grade approved for use in the Montrose area is PG 64-22 or PG 58-28 Non-Modified Binder and PG 64-28 Modified Binder.

- (1) **Composition of Mixture.** The HMA plant mix shall be composed of a mixture of well-graded aggregate, filler (if required), bituminous material and anti-stripping additive. The several aggregate fractions shall be sized, handled in separate size groups and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula.
- (2) **Job Mix formula.** No HMA mixture shall be produced until the City Engineer has approved a job mix formula.
 - (a) The job mix formula shall be submitted in typed form by the contractor to the City Engineer at least 10 days prior to the start of paving operations.

TABLE 4 – DESIGN CRITERIA	
Test Property	Requirements
Stability	28 min
Compaction Gyration (N design)	75*
Air Voids (percent by volume of mix)	3.0 to 5.0
Voids Filled (percent by volume of mix)	65 TO 78
Voids in Mineral Aggregate	See Table 5

* On roadways with high traffic loading, N_{design} greater than 75 gyrations may be specified by the Engineer of record (See Table 2-1 in the *CAPA Guideline for the Design and Use of Asphalt Pavements for Colorado Roadways*)

TABLE 5 – VOIDS IN MINERAL AGGREGATE (VMA)				
Nominal Maximum Particle Size *		Minimum VMA (percent)		
		Percent Design Air Voids		
mm	In.	3.0	4.0	5.0
9.5	3/8	14	15	16
12.5	1/2	13	14	15
19	3/4	12	13	14
25	1	11	12	13
37.5	1-1/2	10	11	12

* The nominal maximum particle size is one sieve size larger than the first sieve to retain more than 10 percent.

- (b) The maximum size aggregate used shall not be more than one-third (1/3) of the thickness of the lift being constructed. (3:1 ratio)

- (c) Job mix control testing shall be performed by the contractor at the start of plant production and in conjunction with calibration of the plant for the job mix formula. It should be recognized that the aggregates produced by the plant may not satisfy the gradation requirements or produce a mix that exactly meets the job mix formula. In those instances, it will be necessary to reevaluate and redesign the mix using plant-produced aggregates. Personnel performing sampling and testing of HMA mixtures in the lab and field shall possess the appropriate LabCat certification or combination of certifications for all sampling and testing performed.
- (D) **Testing Laboratory.** The laboratory used to develop the job mix formula shall meet the requirements of ASTM D 3666 and CDOT. All testing laboratories either developing the job mix formula or performing QA or QC testing shall participate in a gyratory compactor correlation procedure prior to each paving season. This will involve compaction of like samples, and applying a correction factor to the specific gravity of compacted specimens based on a mean value established from all collected data. Each laboratory will be notified when and where the prepared samples can be picked up for testing. A certification signed by the manager of the laboratory stating that it meets these requirements shall be submitted to the Engineer prior to the start of construction. The certification shall contain as a minimum:
- (a) Qualifications of laboratory manager, supervising technician and testing technicians.
 - (b) A listing of equipment to be used in developing the job mix.
 - (c) A copy of the laboratory's quality control system.
 - (d) Evidence of participation in the AASHTO Materials Reference Laboratory (AMRL) program.
- (E) **Job Mix Testing Requirements.** All commercial testing and laboratory work necessary to establish the job mix formula and all testing necessary to assure conformance of materials and workmanship to the requirements of the specifications shall be at the Contractor's expense. Two (2) copies of all test reports shall be submitted directly to the City Engineer.
- (F) **Volumetric Tolerances.** HMA mix design volumetric tolerances for the approved HMA mixture shall be within the limits shown in Table 6. Mixture being produced by the plant shall be verified prior to the start of the placement of the mixture. Verification shall be performed by a **LabCAT Level C** certified technician to verify the volumetric properties of the mixture. If the mixture has been produced for another project within the last 90 days, verification results from that project may be submitted for this verification.

TABLE 6 - HMA MIXTURE DESIGN VERIFICATION TOLERANCES	
Property	Tolerances
Air Voids	± 1.2%
VMA	± 1.2%
Binder Content	± 0.3%
Stability	applicable minimum

- (G) **Lift Thickness.** Each lift of compacted HMA shall be of uniform thickness. The minimum compacted lift thickness shall be three (3) times the maximum nominal aggregate size. The maximum thickness shall be 3 inches unless the contractor can demonstrate the ability to achieve compaction of thicker lifts.
- (H) **Patching.** All trenches and excavations in collector or arterial street shall be patched before the street is reopened to traffic. All longitudinal trenches shall be repaved with an asphalt paving machine. The contractor shall maintain all temporary patches until a permanent patch is installed. Between October 15th and May 1st a 5-inch thick concrete cap will be required on all exactions in asphalt section of right-of-way.
- (I) **Prime Coat.**
- (1) **Surface Prep.** Before applying the prime coat all loose material shall be removed from the surface. That portion of the surface prepared for treatment shall be dry and in satisfactory condition. Dust or contamination of prime coats shall require brooming and reapplication.
 - (2) **Emulsified Application.** Asphalt Emulsified Prime (AEP) shall be applied in accordance with the manufactures recommendations. The prime coat shall be carefully applied. If excessive amounts of curb, sidewalks, or other structures are sprayed with liquid asphalt, they shall be cleaned at the Contractor's expense. The prime coat shall not be applied when the surface is excessively wet or when the atmospheric temperature is less than 40 degrees Fahrenheit, when precipitation is imminent, or as recommended by the manufacturer.
 - (3) **Curing.** Curing shall be required for all prime and tack coats. The prime or tack coat shall be sticky, or tacky, when cured. The length of time required for curing shall depend on the air temperature, humidity and wind conditions and shall be black when cured. The prime coat shall be allowed to cure for a minimum of 24 hours prior to the paving operation. If after the curing period the prime coat has not penetrated the base material, and the surface must be used by traffic, a suitable blotter material shall be applied in amounts needed to absorb excess liquid asphalt. The blotter material shall be a dry, gritty sand.

- (4) Coverage. Prime coat AE-P shall be uniformly applied at a rate of 0.3 gallons per square yard to the surface of the aggregate base course. Application rates for other approved prime coat materials shall be as specified in the Contract Documents or as directed by the Engineer.

(J) **Tack Coat.** When tack coat is specified on the approved plans or required by the City Engineer, all materials and construction shall be in accordance with the requirements of the CDOT Standard Specifications, Section 407. Tack coat shall be applied where additional HMA is to be placed over existing asphalt or Portland cement surfaces. Tack coats shall not be required where HMA is less than twenty-four (24) hours old and remains free of dust, dirt or debris.

- (1) Surface Preparation. Before applying the tack coat all loose material shall be removed from the surface. That portion of the surface prepared for treatment shall be dry and in satisfactory condition. Dust or contamination of prime or tack coats shall require brooming and reapplication.
- (2) Liquid Asphalt. The liquid asphalt used for tack coat shall be an emulsified asphalt grade CSS-1h or SS-1h and shall satisfy the requirements of ASTM D977. Other emulsified asphalts may be used upon written permission of the City Engineer.
- (3) Application. The surface shall be allowed to cure to permit drying and setting of the tack coat prior to the paving operation. A 1:1 dilution should be applied at the rate of 0.05 to 0.15 gallons per square yard. A wand, or hand spray nozzle attached to the spray bar can be used for applying tack to gutter faces, valve boxes, manholes and rings.

(K) **Surface Smoothness.** The final riding surface of all pavement is subject to testing by the 10-foot straightedge method. The Contractor shall furnish an approved 10-foot straightedge and depth gauge and provide an operator to aid the Engineer in testing the finished pavement surface. Areas to be tested shall be determined by the City Engineer or the Construction Inspector. The variation between any two contacts with the surface shall not exceed 3/16 inch in 10 feet. Areas showing deviation of more than 3/16 marked and corrected at the Contractor's expense.

(L) **Asphalt Content.** Asphalt content shall be determined a part of the Contractor's Quality Control. If the materials are within the specification limits, the lot shall be acceptable. Volumetrics falling outside the limits of the job mix formula will warrant corrective action, which may include removal and replacement of the represented day's production.

- (M) **Traffic Control Plan.** If a Traffic Control Plan (TCP) is not provided in the plans, then the Contractor shall furnish one. The TCP shall be prepared by an ATSSA Certified Technician in accordance with part VI of the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD). The Contractor shall submit the TCP to the Engineer for review at least two (2) working days before the pre-construction meeting. Manual on Uniform Traffic Control Devices (MUTCD), latest edition. The Contractor shall submit the TCP to the Engineer for review at least two (2) working days before the pre-construction meeting.

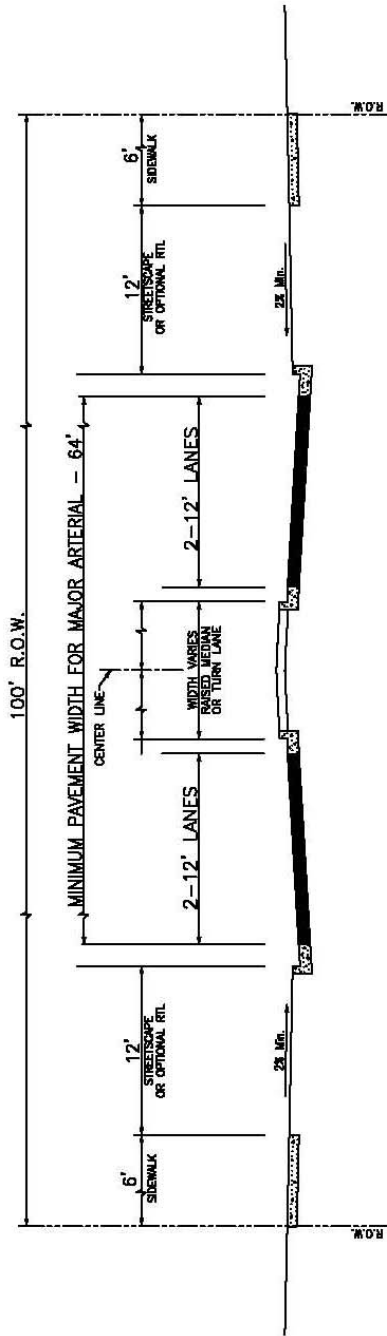
9-4-6: FINAL INSPECTION AND ACCEPTANCE

- (A) The acceptance of all road and bridge improvements by the City will be based on the following.
- (1) Submittal of results of all required quality control (QC) and quality assurance (QA) tests certified by the Engineer or a qualified independent laboratory.
 - (2) Submittal of a copy of the daily inspection reports prepared by the Engineer or his representative.
 - (3) Passing a final inspection of the work by the City Engineer or his representative.
 - (4) Two sets of As-Built construction drawings shall be submitted on 24" x 36" or 22" x 34" paper or vellum in accordance with the Montrose submittal standards in Chapter 9-1. An Engineer shall stamp and sign all As-Built drawings prior to submittal. As-Built drawings shall also be submitted as an electronic AutoCAD file in accordance with the Montrose submittal standards in Chapter 9-1.
 - (5) The Contractor shall guarantee all portions of the street against defective workmanship and materials for a period of one year after completion and shall keep the street in good repair during that period. The determination of the necessity, during such guarantee period, for the Contractor to repair said street, or any portion thereof, shall rest entirely with the City Engineer, whose decision upon the matter shall be final and obligatory upon the Contractor.

9-4-7: STREET SYSTEM DETAILS


- ST-01 Major Arterial
- ST-02 Minor Arterial
- ST-03 Collector
- ST-04 Urban/Residential Street
- ST-05 Two-Way Shared Off Street Path on Separate R.O.W.
- ST-06 Alley
- ST-07 Site Zone Detail
- ST-08 Utility Locations and Multi-Purpose Easement Detail
- ST-09 Cul-De-Sac Turn Around – Commercial/Industrial Court
- ST-10 Cul-De-Sac Turn Around – Residential Court
- ST-11 General Notes for Utility Easements

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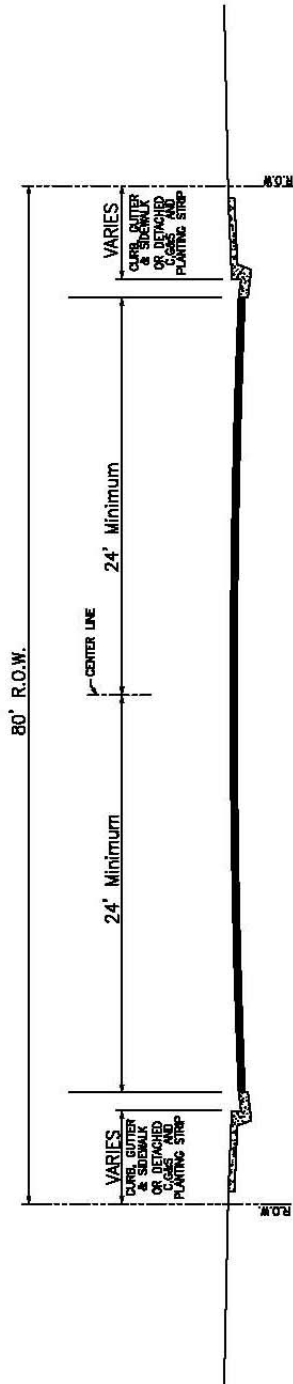


- ① SEE THE MONTROSE COMPREHENSIVE PLAN TRANSPORTATION DESIGN GUIDELINES MAP FOR MAJOR ARTERIAL STREET DESIGNATIONS.
- ② VERTICAL CURBS, GUTTERS AND SIDEWALKS ARE REQUIRED ON BOTH SIDES OF ALL ARTERIAL STREETS.
- ③ ATTACHED SIDEWALKS MAY BE APPROVED WHERE EXISTING DEVELOPMENT PRECLUDES CONSTRUCTION OF DETACHED SIDEWALKS.
- ④ ALL STREETS AND ROADWAYS SHALL BE SURFACED WITH HOT BITUMINOUS PAVEMENT (HBP) OR PORTLAND CEMENT CONCRETE (PCC). ALL PAVEMENTS SHALL BE DESIGNED IN ACCORDANCE WITH THE AASHTO GUIDE FOR DESIGN OF PAVEMENT STRUCTURES.
- ⑤ ADDITIONAL RIGHT-OF-WAY WIDTH WILL BE REQUIRED FOR CONSTRUCTION OF RIGHT TURN DECELERATION LANES.

MAJOR ARTERIAL

 <p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT</p>	<p>STANDARD STREET DETAILS</p>	<p>APPROVED: <u>YAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>GLR</u></p>	<p>PAGE ST-01</p>
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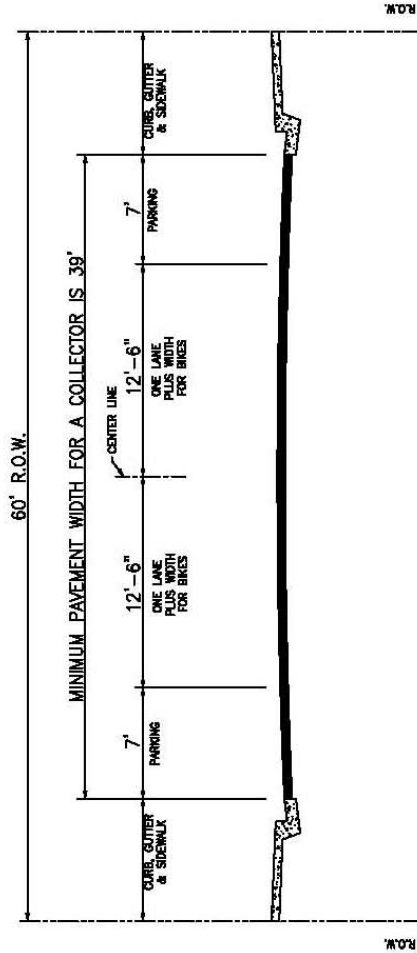


- ① SEE THE MONTROSE COMPREHENSIVE PLAN TRANSPORTATION DESIGN GUIDELINES MAP FOR MINOR ARTERIAL STREET DESIGNATIONS. MINIMUM PAVEMENT WIDTH FOR A MINOR ARTERIAL IS 48 FEET.
- ② VERTICAL CURBS, GUTTERS AND SIDEWALKS ARE REQUIRED ON BOTH SIDES OF ALL ARTERIAL STREETS.
- ③ ALL ARTERIAL STREETS SHALL BE SURFACED WITH HOT BITUMINOUS PAVEMENT (HBP) OR PORTLAND CEMENT CONCRETE (PCC). ALL PAVEMENTS SHALL BE DESIGNED IN ACCORDANCE WITH THE AASHTO GUIDE FOR DESIGN OF PAVEMENT STRUCTURES.
- ④ ADDITIONAL RIGHT-OF-WAY WIDTH WILL BE REQUIRED FOR CONSTRUCTION OF RIGHT TURN DECELERATION LANES.

MINOR ARTERIAL

<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD STREET DETAILS</p>	<p>APPROVED: <u>SLR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>SLR</u></p>	<p>PAGE ST-02</p>
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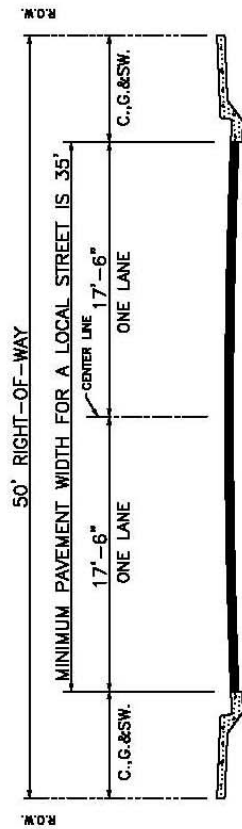


- ① SEE THE CITY OF MONTROSE COMPREHENSIVE PLAN TRANSPORTATION DESIGN GUIDELINES MAP FOR COLLECTOR STREET DESIGNATIONS.
- ② VERTICAL CURBS, GUTTERS AND SIDEWALKS ARE REQUIRED ON BOTH SIDES OF ALL COLLECTOR STREETS.
- ③ ALL COLLECTOR STREETS SHALL BE SURFACED WITH HOT BITUMINOUS PAVEMENT (HBP) OR PORTLAND CEMENT CONCRETE (PCC). ALL PAVEMENTS SHALL BE DESIGNED IN ACCORDANCE WITH THE AASHTO GUIDE FOR DESIGN OF PAVEMENT STRUCTURES.
- ④ ADDITIONAL RIGHT-OF-WAY WIDTH WILL BE REQUIRED FOR CONSTRUCTION OF RIGHT TURN DECELERATION LANES.

COLLECTOR

<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION</p> <p>QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD STREET DETAILS</p>	<p>APPROVED: <u>LAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>ELR</u></p>	<p>PAGE ST-03</p>
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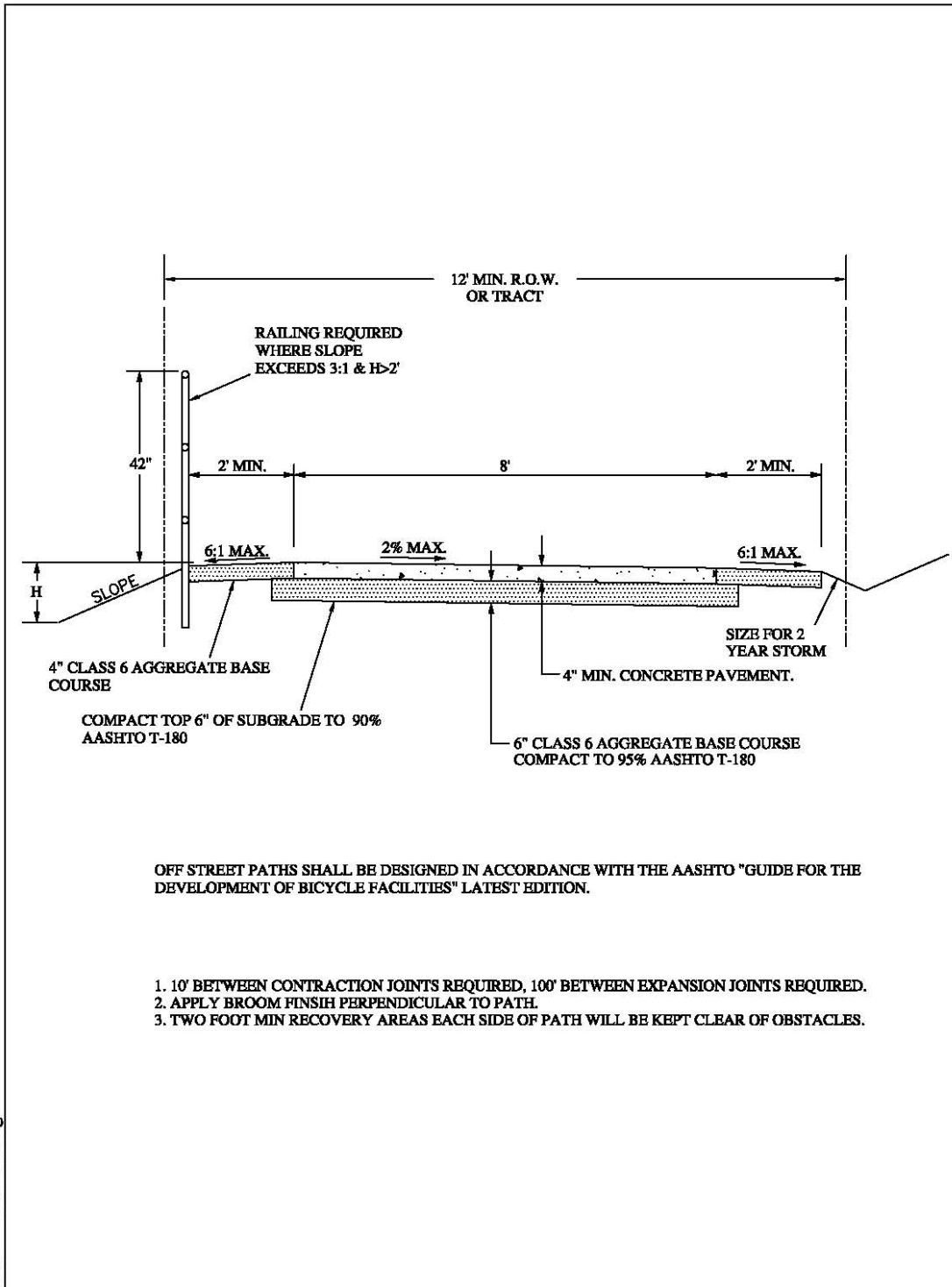
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- ① DRIVE OVER CURB, GUTTER AND SIDEWALK SHALL BE INSTALLED ONLY ON URBAN RESIDENTIAL STREETS WITH LESS THAN 1000 A.D.T.
- ② ALL URBAN RESIDENTIAL STREETS SHALL BE SURFACED WITH HOT MIX ASPHALT (HMA) OR PORTLAND CEMENT CONCRETE (PCC). ALL PAVEMENTS SHALL BE DESIGNED IN ACCORDANCE WITH THE AASHTO GUIDE FOR DESIGN OF PAVEMENT STRUCTURES.

URBAN/RESIDENTIAL STREET

 CITY OF MONTROSE	PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!	STANDARD STREET DETAILS	APPROVED: <u>JAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>ELR</u>	PAGE ST-04
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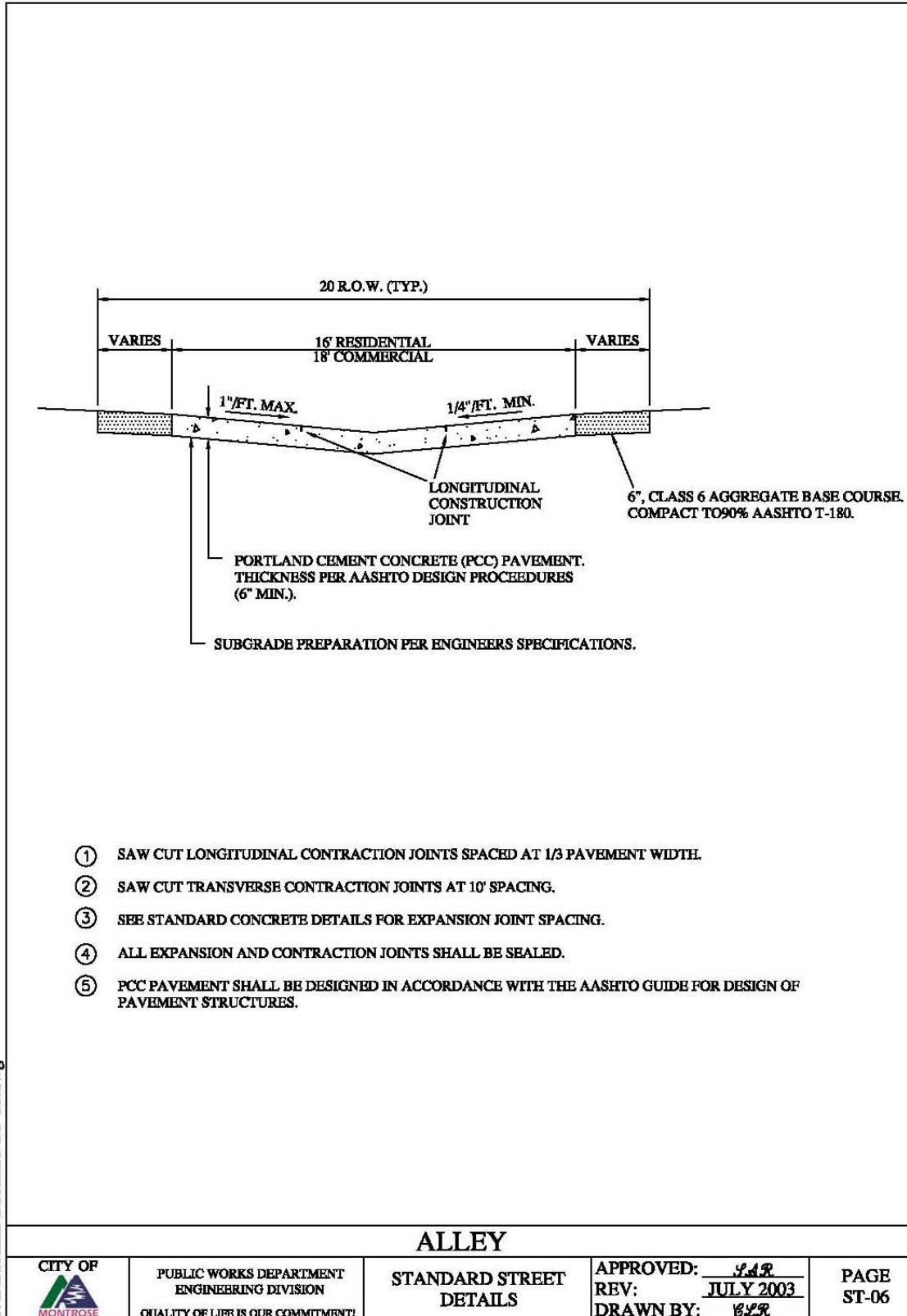


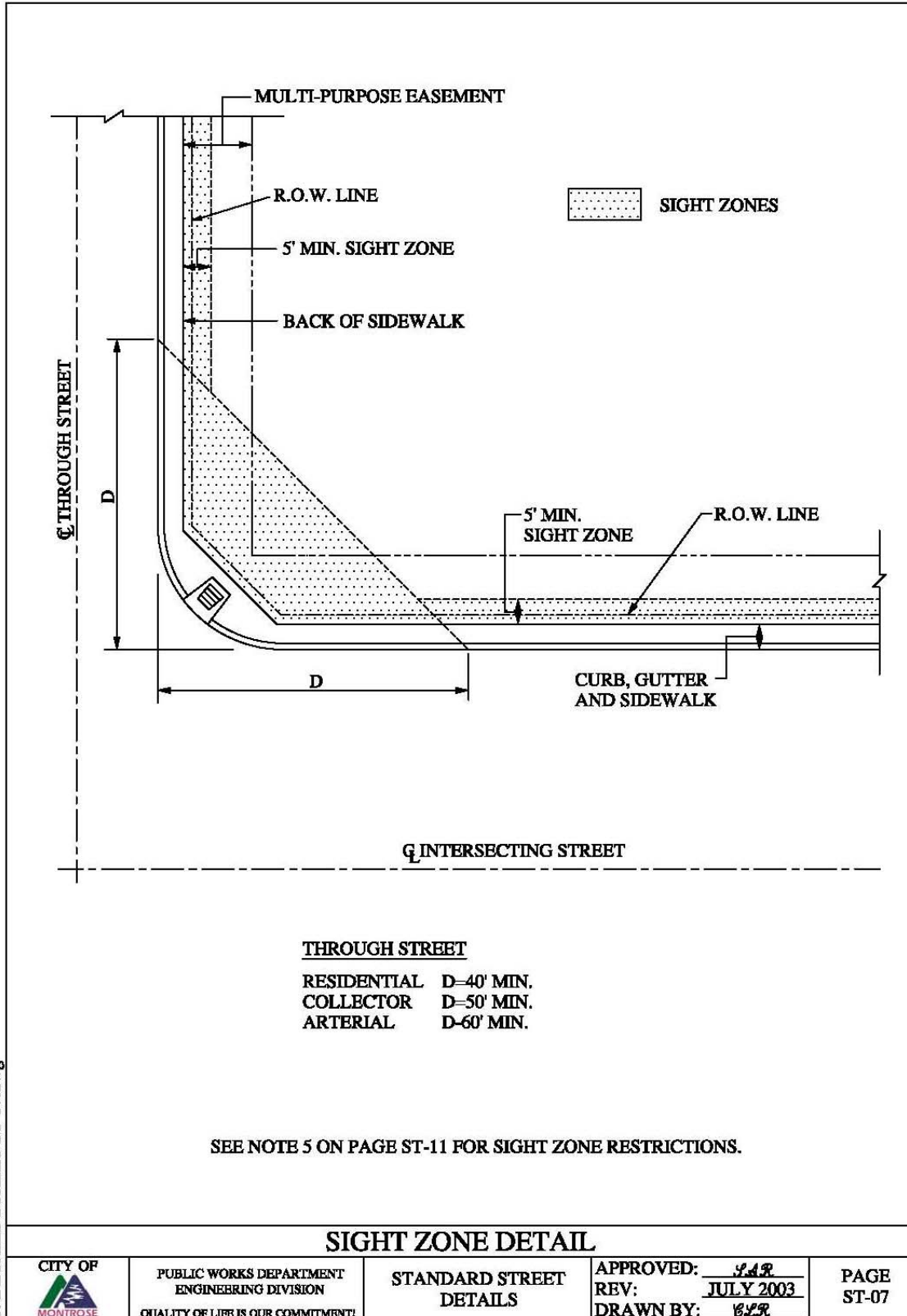
OFF STREET PATHS SHALL BE DESIGNED IN ACCORDANCE WITH THE AASHTO "GUIDE FOR THE DEVELOPMENT OF BICYCLE FACILITIES" LATEST EDITION.

1. 10' BETWEEN CONTRACTION JOINTS REQUIRED, 100' BETWEEN EXPANSION JOINTS REQUIRED.
2. APPLY BROOM FINISH PERPENDICULAR TO PATH.
3. TWO FOOT MIN RECOVERY AREAS EACH SIDE OF PATH WILL BE KEPT CLEAR OF OBSTACLES.

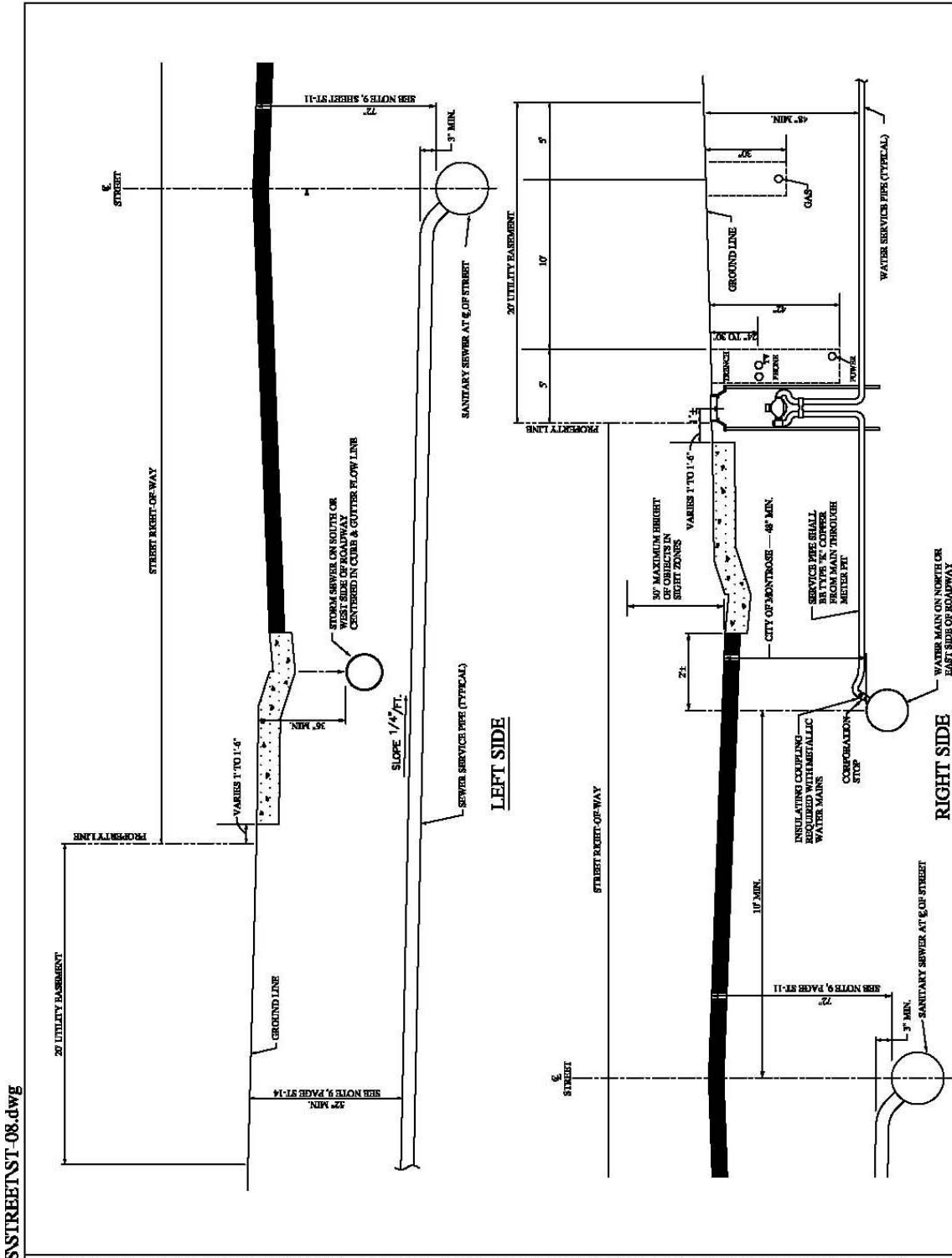
TWO-WAY SHARED USE OFF STREET PATH ON SEPARATE R.O.W.

 <p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION</p> <p>QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD STREET DETAILS</p>	<p>APPROVED: <u>LAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>ELR</u></p>	<p>PAGE ST-05</p>
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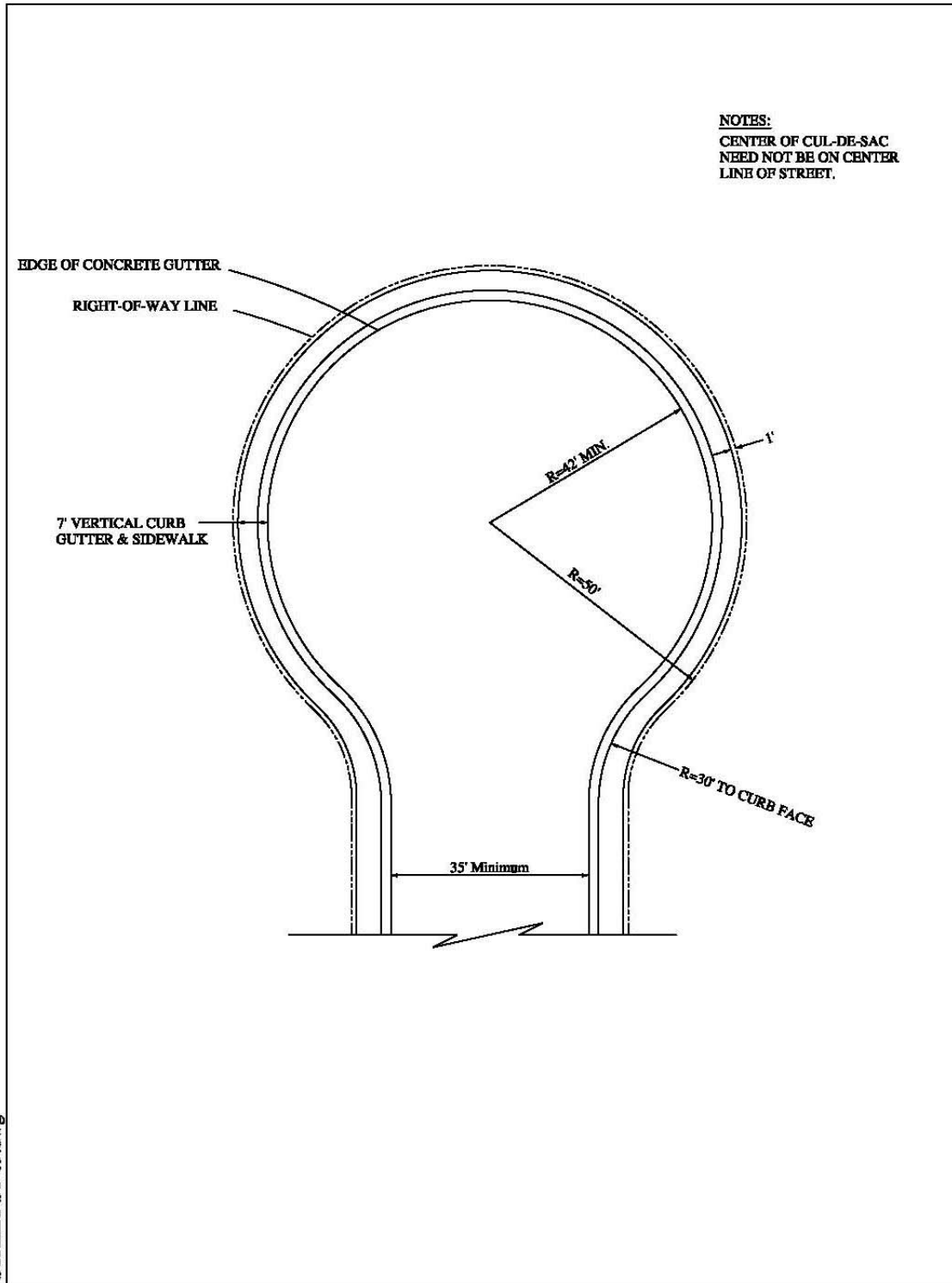
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UTILITY LOCATIONS AND MULTI-PURPOSE EASEMENT DETAIL

 <p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT</p>	<p>STANDARD STREET DETAILS</p>	<p>APPROVED: <i>JLR</i> REV: <u>JULY 2003</u> DRAWN BY: <i>JLR</i></p>	<p>PAGE ST-08</p>
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CUL-DE-SAC TURN AROUND - COMMERCIAL/INDUSTRIAL COURT

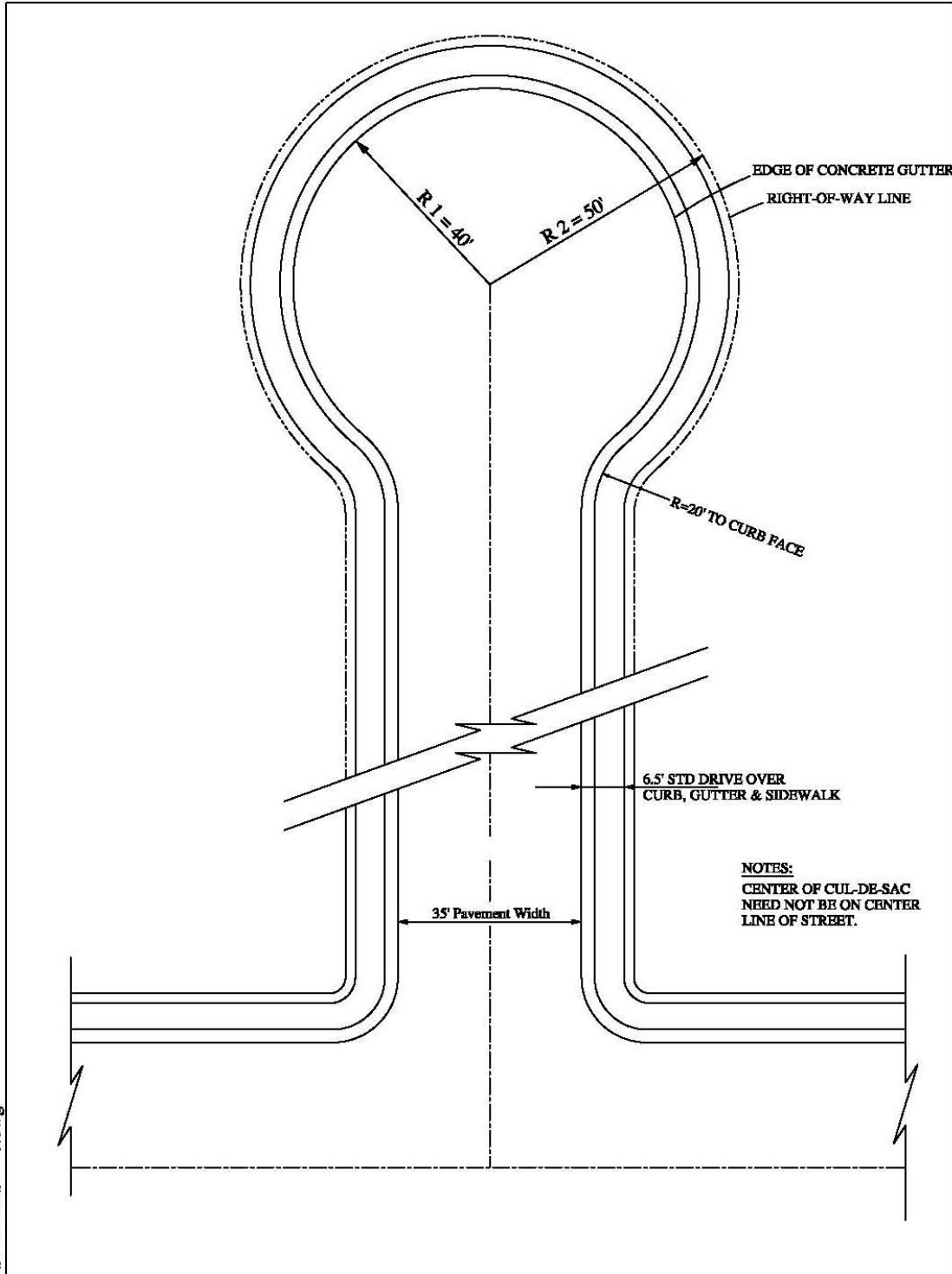


PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION
QUALITY OF LIFE IS OUR COMMITMENT!

STANDARD STREET
DETAILS

APPROVED: JAR
REV: JULY 2003
DRAWN BY: ELR

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CUL-DE-SAC TURN AROUND - RESIDENTIAL COURT

<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD STREET DETAILS</p>	<p>APPROVED: <u>LAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>ELR</u></p>	<p>PAGE ST-10</p>
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1. A CONTINUOUS UTILITY EASEMENT SHALL BE PROVIDED ON BOTH SIDES OF ALL ROAD RIGHTS-OF-WAY. THIS EASEMENT SHALL BE RESERVED FOR PURPOSES INCLUDING, BUT NOT LIMITED TO INSTALLATION AND MAINTENANCE OF PUBLIC UTILITIES, TRAFFIC CONTROL SIGNS AND SIGNALS, STREETScape, STREET TREES, AND SPRINKLING SYSTEMS, EARTH RETAINING STRUCTURES AND SURFACE SLOPING OR GRADING REQUIRED FOR STREET CONSTRUCTION.

UTILITY COMPANIES AND/OR THE CITY OF MONTROSE SHALL NOT BE RESPONSIBLE FOR DAMAGE TO PLANTINGS, IRRIGATION SYSTEMS, FENCES, OR OTHER APPURTENANCES LOCATED OR CONSTRUCTED WITHIN THE MULTI-PURPOSE EASEMENT WHEN SUCH DAMAGE RESULTS FROM THE INSTALTLATION AND/OR REPAIR OF UTILITIES WITHIN SAID UTILITY EASEMENT.
2. IRRIGATION DISTRIBUTION LINES SHALL BE LOCATED IN A SEPARATE EASEMENT LOCATED ON THE HOUSE SIDE OF THE UTILITY EASEMENT, OR AT THE BACK LOT LINE.
3. PROPERTY OWNERS MAY LANDSCAPE THE FULL WIDTH OF THE MULTI-PURPOSE EASEMENTS. SPRINKLING SYSTEMS INSTALLED WITHIN UTILITY EASEMENTS SHALL NOT BE GREATER THAN 18" BELOW THE GROUND SURFACE.
4. STREET TREES SHALL BE LOCATED 5' FROM THE BACK OF SIDEWALK AND NO LESS THAN 10' FROM ANY DRIVEWAY. NO TREES SHALL BE PLANTED WITHIN THE UTILITY EASEMENT WITHOUT APPROVAL OF THE SPECIES AND LOCATION BY THE CITY PARKS SUPERINTENDENT.
5. NO TREES, SHRUBS, HEDGES, FENCES, WALLS, OR OTHER OBSTRUCTIONS OVER 30" IN HEIGHT, MEASURED AT THE NEAR EDGE OF ROADWAY, SHALL BE LOCATED WITHIN SIGHT ZONES. EXCEPTIONS WILL BE MADE FOR UTILITY POLES, TRAFFIC CONTROL SIGNS, TRAFFIC SIGNAL POLES AND "OPEN TYPE" FENCES. CHAIN LINK OR OTHER "OPEN TYPE" FENCES UP TO 48 INCHES IN HEIGHT MAY BE INSTALLED ON THE RIGHT-OF-WAY LINE. SEE THE CITY ZONING AND DEVELOPMENT CODE FOR FENCE HEIGHT AND PERMIT REQUIRMENTS.
6. ALL FIRE HYDRANTS AND WATER METERS SHALL REMAIN UNOBSTRUCTED AND ACCESSIBLE AT ALL TIMES. NO FENCES, PLANTINGS, STRUCTURES OR OTHER OBSTACLE SHALL BE LOCATED WITHIN 3' OF ANY FIRE HYDRANT OR WATER METER. NO FENCES OR OTHER OBSTRUCTION SHALL BE LOCATED ON THE STREET SIDE OF ANY FIRE HYDRANT OR WATERMETER.
7. SANITARY SEWER MANHOLES SHALL BE LOCATED AT CENTER LINE OF TRAFFIC LANE.
8. DUE TO DEPTHS OF EXISTING SEWER LINES, IT MAY NOT BE POSSIBLE TO EXTEND NEW SEWER MAINS AT THE MINIMUM DEPTHS SHOWN ON THE TYPICAL STREET SECTION. WHERE SANITARY SEWER MAIN AND SERVICE LINES ARE INSTALLED AT DEPTHS LESS THAN THE MINIMUM SHOWN, IT SHALL BE THE RESPONSIBILITY OF THE DEVELOPER OR PROPERTY OWNER TO ADEQUATELY MARK THE LOCATION AND DEPTH OF THE SERVICE PIPE AND NOTIFY OTHER UTILITY COMPANIES OF SHALLOW SEWER SERVICES.

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GENERAL NOTES FOR UTILITY EASEMENTS

 <p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT</p>	<p>STANDARD STREET DETAILS</p>	<p>APPROVED: <u>ELR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>ELR</u></p>	<p>PAGE ST - 11</p>
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CHAPTER 9-5

CONCRETE STANDARDS

Sections:

- 9-5-1 GENERAL PROVISIONS**
- 9-5-2 MIX DESIGN CRITERIA**
- 9-5-3 MATERIALS SPECIFICATIONS**
- 9-5-4 STEEL REINFORCEMENT AND FORMS**
- 9-5-5 CONCRETE PLACEMENT**
- 9-5-6 JOINTS AND JOINT SPACING**
- 9-5-7 FINISHING AND CURING**
- 9-5-8 EXTREME WEATHER PROTECTION**
- 9-5-9 TESTING, FINAL INSPECTION, AND ACCEPTANCE**
- 9-5-10 FLOWCRETE/FLOWFILL SPECIFICATIONS**
- 9-5-11 CONCRETE DETAILS**
- 9-5-1: GENERAL PROVISIONS**

- (A) **General.** Concrete work within any street, park, trail or alley ROW or in any part of the water system, wastewater system, parks, and storm drainage system of the City shall meet the requirements of these Standards and Specifications. Engineering, plans, licenses, permits, inspection, warranties and acceptance shall be as detailed in these applicable Standards and Specifications for the type of construction involved.

Permits shall be obtained before work begins. Responsible Party shall notify the City Engineer's office forty-eight (48) hours prior to placement of concrete, and request a site inspection by the City Engineer or his representative to determine whether site conditions meet these Standards for placing concrete. Written or oral notice of Inspector's approval to place materials shall be obtained by

Responsible Party after inspection has been made and before concrete is placed. Written notice of rejection shall be given to Responsible Party in the event any aforementioned conditions given by the City Engineer are not met, and work shall be halted until such time as corrective action is taken. Copies of the approved drawings and the permit shall be on the job site and available to the Inspector.

9-5-2: MIX DESIGN CRITERIA

- (A) **General.** Concrete shall be thoroughly mixed in a batch mixer of an approved type and capacity for a period of not less than two (2) minutes after the materials, including the water, have been placed in the drum. During the period of mixing, the drum shall be operated at the speed specified by the manufacturer of the equipment. The entire contents of the mixer shall be discharged before recharge, and the mixer shall be cleaned frequently. The concrete shall be mixed only in such quantities that are required for immediate use. Re-tempering of concrete is generally not permitted. Re-tempering may be approved on a case-by-case basis and a minimum slump of 4-inches shall be maintained. Hand-mixed concrete shall not be permitted except by written approval of the City Engineer, and then in only small quantities or in case of an emergency.
- (B) **Proportioning.** Proportioning the "dry" constituents of concrete mixtures shall be accomplished by weighing. The Responsible Party shall provide adequate and accurate scales for this work. Scales shall be accurate within the allowable tolerances as prescribed by state law. The scales shall be sealed by the measurement standards section of the Colorado Department of Agriculture at least once each year, each time the scales are relocated, and as often as the Engineer may deem necessary. Weighers certified by the measurement standards section of the Colorado Department of Agriculture shall operate Scales. The certified weigher shall perform the duties according to the Colorado Department of Agriculture's regulations. There shall be no variance permitted in the minimum cement factor (sacks per cubic yard) as specified for the mix design. The total quantity of mixing-water per sack of cement, including free water in the aggregates, shall not exceed the maximum specified herein. The Responsible Party shall be responsible for developing the proper proportions of aggregates, cement and water that shall conform to the various requirements of these Standards and Specifications. Mix design shall be submitted to the City, along with at least two (2) sets of certified twenty-eight (28) day test results, for review and approval. No concrete shall be incorporated into the work until the City Engineer approves the proportions.
- (C) **Classification.** The classification shall conform to CDOT Standard Specifications Table 601-1 for concrete classes and mix requirements for class B, except that Number 57 or Number 67 shall be used.

- (D) **Ready-Mixed Concrete.** The use of ready-mixed concrete in no way relieves the Responsible Party of the responsibility for proportion, mix, delivery, or placement of concrete; concrete must conform to the requirements of these Standards and Specifications and ASTM C-94.

Concrete shall be continuously mixed or agitated from the time the water is added until the time of use and shall be completely discharged from the truck mixer or truck agitator within one and one-half (1½) hours after it comes in contact with the mixing water or with the aggregates. Retempered concrete shall not be allowed.

The City shall have free access to the mixing plant during times of operation. The organization supplying the concrete shall have sufficient plant and transportation facilities to assure continuous delivery of the concrete at the required rate. (The Responsible Party shall collect delivery, or batch, tickets from the driver for concrete used on the project and deliver them to the City Engineer).

- (1) Batch tickets shall provide the following information:

- (a) weight and type of cement;
- (b) weights of fine and coarse aggregates;
- (c) volume (in gallons) of water including surface water on aggregates;
- (d) quantity (cubic yards) per batch;
- (e) times of batching and discharging of concrete;
- (f) name of batch plant;
- (g) name of Responsible Party;
- (h) name and amount of admixture if approved; and,
- (i) date and truck number.

9-5-3: MATERIALS SPECIFICATIONS

- (A) **General.** Concrete shall be composed of Portland cement, aggregate, and water, and shall be reinforced with steel bars, steel wire fabric or fibrous reinforcing where required. No admixture other than air-entraining agents, or water-reducing agents shall be used without written permission of the City Engineer.

- (B) **Cement.** Cement used in concrete work will be Portland cement conforming to the requirements of ASTM C-150, Type I, IA, Type I/II modified, II, Type V, or IIA. In general, Type II or IIA shall be used in concrete which shall be in contact with the soil, unless otherwise allowed or directed by the City Engineer. Cement, which for any reason has become partially set or which contains lumps of caked cement, shall be rejected.

The Responsible Party shall be responsible for the proper storage of cement until it is used. No damaged cement shall be used in the work, and such cement shall be immediately removed from the site when so ordered by the City Engineer. When requested by the City Engineer, the Responsible Party shall, at his own cost and expense, furnish the City Engineer with a certificate from an acceptable testing laboratory for each lot of cement from which cement is taken for use in the work, stating that the cement meets the requirements of these Standards and Specifications for Portland cement.

- (C) **Water.** Water for concrete shall be clean and free from sand, oil, acid, alkali, organic matter, or other deleterious substances. Water from public supplies or water which has been proven to be suitable for drinking is satisfactory.
- (D) **Admixtures.** The Responsible Party shall use air-entraining admixtures for concrete that will have exposed surfaces. The Responsible Party may elect to use another admixture provided the City Engineer specifically approves the admixture. Admixtures to be used for plasticizing, densifying, or acceleration of hardening of concrete shall, when added to the mixture, produce a concrete of specified strength in seven (7) day and twenty-eight (28) day tests. Documented evidence of acceptability shall be required when new or unknown admixtures are proposed for use. Air-entraining admixtures shall conform to the requirements of ASTM C-260.
- (E) **Fine Aggregate.** Fine aggregate shall be composed of clean, hard, durable, uncoated particles of sand, free from injurious amounts of clay, dust, soft or flaky particles, loam, shale, alkali, organic matter, or other deleterious matter. Fine aggregate shall be well graded from coarse to fine and when tested by means of laboratory sieves shall meet the CDOT Concrete Aggregate Gradation Table and shall also conform to AASHTO M6:

Sieve Size	Percent Passing
3/8"	100
#4	95 - 100
#16	45 - 80
#50	10 - 30
#100	2 - 10

- (F) **Coarse Aggregate.** The coarse aggregate shall consist of broken stone or gravel composed of clean, hard, tough and durable stone and shall be free from soft, thin, elongated or laminated pieces, disintegrated stone, clay, loam, organic, or other deleterious matter.

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Coarse aggregate shall conform to Number 57 or Number 67 course aggregate from the CDOT Concrete Aggregate Gradation Table, which shall also conform to AASHTO M43.

(G) **Fibrous Reinforcing.** Fibrous reinforcing shall be used in Portland cement concrete used for curb, gutter, sidewalks, curb turn fillets, cross pans, and valley pans. Fibrous concrete reinforcement shall consist of one hundred (100) percent virgin polypropylene fibrillated fibers specifically manufactured for use as concrete reinforcement, containing no reprocessed olefin materials. Fibrous concrete reinforcement shall be as manufactured by Fibermesh Company, 4019 Industry Drive, Chattanooga, Tennessee 37416, or approved equivalent. Substitutions may be considered at the discretion of the City Engineer. The following shall be submitted to the City Engineer:

- (1) One copy of manufacturer's printed product data, clearly marked, indicating proposed fibrous concrete reinforcement materials. Printed data should state 1.5 lbs of fiber to be added to each cubic yard of each type of concrete.
- (2) One copy of manufacturer's printed batching and mixing instructions.
- (3) One copy of a certificate prepared by the concrete supplier stating that the approved fibrous concrete reinforcement materials at the rate of 1.5 pounds per cubic yard were added to each batch of concrete delivered to the project site. Each certificate shall be accompanied by one (1) copy of each batch delivery ticket indicating the amount of fibrous concrete reinforcement material added to each batch of concrete.

9-5-4: STEEL REINFORCEMENT AND FORMS

(A) **General.** Before being positioned, reinforcing steel shall be thoroughly cleaned of mill and rust scale and of coatings that will destroy or reduce the bond. Where there is delay in depositing concrete, reinforcement shall be re-inspected and, if necessary, cleaned. Reinforcement shall be carefully formed to the dimensions indicated on the plans by the cold bending method. Cold bends shall be made around a pin having a diameter of six (6) or more times the diameter of the reinforcing bars. Reinforcement shall not be bent and then straightened. Bars with kinks or bends not shown on the plans shall not be used. Precast mortar blocks, or other non-metal supports shall be as approved by ACI. Responsible Party shall submit to the City shop drawings of the reinforcement for his approval. The City Engineer's approval of shop drawings and bar schedules shall not relieve the Responsible Party of fulfilling his responsibilities as outlined in the plans and specifications.

- (B) **Steel Placement.** Reinforcing steel shall be accurately placed and secured against displacement by using annealed iron wire of not less than No. 18 gauge, or by suitable clips at intersections. Where necessary, reinforcing steel shall be supported by metal chairs or spacers, precast mortar blocks, or metal hangers. Splicing of bars, except where shown on the plans, shall not be permitted without approval of the City Engineer.

Unless otherwise shown on the plans, the minimum clear cover for reinforcing steel shall be the following, which is specified in ACI 301, Section 5.5:

- (1) Bottom bars on soil bearing foundations and slabs, three (3) inches
 - (2) Bars adjacent to exposed surfaces or earth backfill:
 - (a) For bars more than three-quarter ($\frac{3}{4}$) inch in diameter, two (2) inches
 - (b) For bars three-quarter ($\frac{3}{4}$) inch or less in diameter, one and one-half ($1\frac{1}{2}$) inches
 - (3) Interior Surfaces: slabs, walls, joints with one and three-eighths ($1\frac{3}{8}$) inch diameter or smaller, three-quarter ($\frac{3}{4}$) inch
- (C) **Welded Wire.** Welded wire fabric for concrete reinforcement shall be of the gauge, spacing, dimensions, and form specified on the plans or detailed drawings and shall comply with "Specifications for Welded Steel Wire Fabric for Concrete Reinforcement" (ASTM A-185-02) or "Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement" (ASTM A-497). Welded wire fabric shall be adequately supported and in no case will WWF smaller than 6X6/4X4 be used.

- (D) **Forms.** Whenever necessary, forms shall be used to confine the concrete and shape it to the required lines. Forms shall have sufficient strength to withstand, without deformation, the pressure resulting from placement and vibration of the concrete. Forms shall be constructed so that the finished concrete shall conform to the shapes, lines, grades and dimensions indicated on the approved plans. Any form which is not clean and has not had the surface prepared with a commercial form oil that shall effectively prevent bonding and that will not stain or soften concrete surfaces shall not be used.

Plywood forms, plastic coated plywood forms, or steel forms shall be used for surfaces requiring forming which are exposed to view, whether inside or outside any structure. Surfaces against backfilled earth, interior surfaces of covered channels, or other places permanently obscured from view, may be formed with forms having sub-standard surfaces.

Forms shall not be disturbed until the concrete has hardened sufficiently to permit their removal without damaging the concrete or until the forms are not required to protect the concrete from mechanical damage. Minimum time before removal of forms after placing concrete shall be one (1) day for footings and Class "B" concrete and two (2) days for other concrete except in curbs, gutters, sidewalks and pavements. The use of slip forms and concrete paving machines shall be encouraged.

9-5-5: CONCRETE PLACEMENT

- (A) **General.** Before depositing concrete, debris shall be removed from the space to be occupied by the concrete and the forms, including any existing concrete surfaces, shall be thoroughly wetted. Concrete shall not be placed until forms and reinforcing steel have been inspected and approved by the City Engineer. Concrete shall be handled from the mixer to the place of final deposit as rapidly as possible by methods that prevent separation or loss of ingredients. The concrete shall be deposited in the forms as nearly as practicable in its final position to avoid rehandling. It shall be deposited in continuous layers, the thickness of which generally shall not exceed twelve (12) inches. Concrete shall be placed in a manner that shall avoid segregation and shall not be dropped freely more than five (5) feet. If segregation occurs, the City Engineer may require the concrete to be removed and replaced at the Responsible Party's expense. Concrete shall be placed in one continuous operation, except where keyed construction joints are shown on the plans or as approved by the City Engineer. Concrete slump shall not exceed four (4) inches. Delays in excess of thirty (30) minutes may require removal and replacement of that pour, as determined by the City Engineer.
- (B) **Subgrade Preparation.** The subgrade shall be excavated or filled to the required grades and lines. Soft, yielding, or otherwise unsuitable material shall be removed and replaced with suitable material. Filled sections shall be compacted and compaction shall extend a minimum of six inches outside the form lines. The subgrade shall be compacted to the density shown on the plans and trimmed to provide a uniform surface at the correct elevation.
- (C) **Vibrating.** Concrete shall be thoroughly compacted and/or vibrated. Concrete shall be compacted by internal vibration using mechanical vibrating equipment, except that concrete in floor slabs, sidewalks, or curb and gutter, not poured against form linings, shall be either tamped or vibrated. Care shall be taken in vibrating the concrete to vibrate only long enough to bring a continuous film of mortar to the surface. Vibration shall stop before any segregation of the concrete occurs. Mechanical vibrators shall be an approved type as specified in ACI Publication 309, Chapter 5. Vibrators shall not be used to move or spread the concrete.

Any evidence of the lack of consolidation or over-consolidation shall be regarded as sufficient reason to require the removal of the section involved and its replacement with new concrete at the Responsible Party's expense. The Responsible Party shall be responsible for any defects in the quality and appearance of the completed work.

(D) **Workability.** The consistency of concrete shall be kept uniform for each class of work and shall be checked by means of slump tests or Kelly ball tests. The workability of the concrete shall be varied as directed by the City Engineer. Concrete shall have a consistency such that it can be worked into corners and angles of the forms and around joints, dowels and tie-bars by the construction methods, which are being used without excessive spading, segregation or undue accumulation of water or latent material on the surface. If, through accident, intention, or error in mixing, concrete fails to conform to the proportions of the approved mix design, such concrete shall not be incorporated in the work but shall be properly disposed of off the project site as waste material at the Responsible Party's expense. If water is added at the job site, slump tests shall be run and test cylinders cast following the addition of the water. In no case shall concrete slump exceed four (4) inches. Expenses incurred in excess of ordinary tests shall be borne by the Responsible Party.

(E) **Backfilling.** When side forms are removed and the concrete has gained sufficient strength, the space adjoining the concrete shall be promptly backfilled with suitable material, properly compacted, and brought flush with the surface of the concrete and adjoining ground surface. In embankments, the backfill shall be level with the top of the concrete for at least two (2) feet and then sloped as shown on the drawings or as directed by the City Engineer.

When the area behind the walk is to be paved, a minimum of three (3) inches of asphaltic surfacing and six (6) inches of base course shall be used and shall be constructed in accordance with these Standards and Specifications. Existing pavement, which is damaged during construction shall be repaired by the Responsible Party at his expense. Patching required to match existing asphalt or concrete shall be the Responsible Party's responsibility.

(F) **Repairs.** After stripping of the forms, if any concrete is found to be not formed as shown on the drawings or is out of alignment or level, or shows a defective surface, it shall be considered as not conforming with the intent of these Standards and Specifications and shall be removed and replaced by the Responsible Party at his expense unless the City Engineer gives written permission to patch the defective area. In this case, patching shall be done as described in the following paragraphs. Defects that require replacement or repair are those that contain honeycomb, damage due to stripping of forms, loose pieces of concrete, bolt-holes, tie-rod holes, uneven or excessive ridges at form joints, and bulges due to movement of the forms. Ridges and bulges shall be removed

by grinding. Honeycombed and other defective concrete that does not affect the integrity of the structure shall be chipped out, and the vacated areas shall be filled in a manner acceptable to the City Engineer. The repaired area shall be patched with a non-shrink, non-metallic grout with a minimum compressive strength of five thousand (5,000) psi in twenty-eight (28) days. Repair areas treated with an epoxy-bonding agent shall have the approval of the City Engineer before the repair filling is placed.

Bolt-holes, tie-rod holes, and minor imperfections as approved by the City Engineer, shall be filled with dry-patching mortar composed of one (1) part Portland cement to two (2) parts of regular concrete sand (volume measurement) and only enough water so that after the ingredients are mixed thoroughly, the mortar shall stick together on being molded. Mortar repairs shall be placed in layers and thoroughly compacted by suitable tools. Care shall be taken in filling rod and bolt holes so that the entire depth of the hole is completely filled with compacted mortar. The mortar mix proportions described above are approximate.

Those areas with excessive deficiencies as determined by the City Engineer shall be removed and replaced at the Responsible Party's expense. Where repairs are made in existing sidewalks, all edges of the old sidewalk allowed to remain shall be sawcut to a minimum depth of two (2) inches. No rough edges shall be permitted where new construction joins the old section. Unless directed by the City Engineer, no section less than five (5) feet in length shall be placed or left in place. Where new sidewalk construction abuts existing sidewalks, the work shall be accomplished so that there is no abrupt change in grade between the old section and the new work.

No addition to existing sidewalks or other flat work concrete shall be made less than four (4) feet in width. The City Engineer may require doweling into the existing concrete.

9-5-6: JOINTS AND JOINT SPACING

(A) **Expansion Joint.** Expansion joint material shall be provided at the following locations and shall be in place prior to the placement of concrete:

- (1) At each end of curb return.
- (2) At both edges of driveway.
- (3) Between back of sidewalk and driveway slab or service walk.
- (4) Between new concrete and existing masonry buildings.
- (5) As shown on the drawings.
- (6) As directed by the City Engineer.
- (7) Between new and existing concrete.

- (8) Every one hundred (100) feet in sidewalk curb and gutter when hand-formed.
- (9) Every two hundred (200) feet in sidewalk, curb and gutter when placed slip formed.
- (10) Inlets

(B) **Contraction Joint.** Transverse joints shall be placed at maximum intervals of ten (10) feet to control random cracking; joints shall be formed, sawed, or tooled to a minimum depth of one-quarter (1/4) of the total thickness. If divider plates are used, the maximum depth of plates shall not be greater than one-half (1/2) depth at the finished surface and shall be no less than one (1) inch.

(C) **Tool Joint.** Tool joints shall be spaced as follows:

- (1) Not more than ten (10) feet nor less than five (5) feet apart in curb and gutter and combination curb-sidewalk.
- (2) Not more than the width of the sidewalk (up to eight (8) feet), nor less than five (5) feet apart in sidewalk.
- (3) At least two (2) joints, equally spaced at not greater than ten(10) foot intervals applicable in driveways.
- (4) As directed by the City Engineer.

(D) **Joint Materials.** Joint materials shall conform to AASHTO, ASTM Specifications according to type as follows:

	<u>AASHTO</u>	<u>ASTM</u>
Concrete joint sealer, hot poured elastic or Cold applied conforming to ASTM C920	M173	D6690-01 C920
Preformed expansion joint filler (Bituminous Type)	M 33	D99-98
Preformed sponge rubber and cork expansion joint fillers	M 153	D1752-84
Preformed expansion joint fillers – non-extruding and resilient bitumen	M 213	D1751-99

9-5-7: FINISHING AND CURING

- (A) **Finishing.** Exposed faces of curbs and sidewalks shall be finished to true-line and grade as shown on the plans. Surface shall be floated to a smooth but not slippery finish. Sidewalk and curb shall be broomed or combed and edged, unless otherwise directed by the City Engineer. After completion of brooming and before concrete has taken its initial set, edges in contact with the forms shall be tooled with an edger having a three-eighths (3/8) inch radius. No dusting or topping of the surface or sprinkling with water to facilitate finishing shall be permitted. Steel trowels shall not be used on air-entrained (exterior service) concrete.

Immediately following the removal of the forms, fins and irregular projections shall be removed from surfaces except from those that are not to be exposed or are not to be waterproofed. On surfaces, the cavities produced by form ties, honeycomb spots, broken corners or edges, and other defects, shall be thoroughly cleaned, moistened with water and carefully pointed and trued with a mortar consisting of cement and fine aggregate. The surface shall be left sound, of acceptable finish, even, and uniform in color. Mortar used in pointing shall not be more than thirty (30) minutes old. Construction and expansion joints in the completed work shall be left carefully tooled and free of mortar and concrete. The joint filler shall be left exposed for its full length with clean and true edges.

- (B) **Curing.** Fresh concrete shall be protected from weather damage and mechanical injury during the curing periods. The use of a membrane-curing compound is required. Membrane curing compound shall be Type 2, Class B in accordance with AASHTO M148. The membrane-curing compound shall be applied at the rate of three hundred (300) square feet per gallon.

Membrane curing compound shall not be used when the concrete surface will be painted. The type of membrane curing compound chosen shall not permanently discolor the concrete surface. Where membrane-curing compound is not used, the curing process shall be carefully adhered to as follows:

- (1) Surfaces being wetted by ponding, spraying, or wetted material shall be kept completely wetted, with an excess of free water on the surface, for the first seventy-two (72) hours. After this period, for the next four (4) days, a wetting schedule shall be followed whereby the concrete is wetted on a schedule approved by the City Engineer.
- (2) Surfaces being protected by waterproof paper or polyethylene plastic cover shall receive special attention during the first seventy-two (72) hours to ensure there is actually free moisture on the surface of the concrete under the waterproof surface. The Engineer may require the

removal of the cover and a wetting of the surface when, in his judgment, there is insufficient moisture for curing. After the first seventy-two (72) hours the cover shall be kept tightly in place for the remainder of the curing period.

- (3) Optional curing processes described herein may be used at discretion of the City Engineer. The selected curing process shall be started as soon as it can be done without injury to the concrete surface. The following curing procedures may be used subject to the approval of the City Engineer:
 - (a) Ponding (for slabs or footings)
 - (b) Membrane curing compound
 - (c) Wet burlap, earth, or cotton mats
 - (d) Waterproof paper or polyethylene plastic cover

9-5-8: EXTREME WEATHER PROTECTION

- (A) **Cold Weather Concreting.** A period when more than three successive days the average daily outdoor temperature drops below 40° F (the average of the highest and lowest temperatures from midnight to midnight) constitutes cold weather concreting conditions. During cold weather concreting conditions, concrete construction shall be accomplished in accordance with ACI 306-R88. December, January, and February are designated as cold weather months and require concrete protection regardless of temperature. In all cases, the concrete supplier shall furnish concrete suitable for placement in cold weather conditions.
- (B) **Proper Placing and Protection of Concrete.** Insulated blankets are required as cover for concrete placed during cold weather. It is the responsibility of the contractor, in extreme conditions, to determine if additional measures are needed to maintain the temperature requirements. The following prohibitions and conditions shall be in effect during cold weather:
 - (1) Concrete shall not be placed on frozen subgrade.
 - (2) Concrete shall not be placed on or against forms covered with snow or ice.
 - (3) Insulating materials shall be available and easily accessible.
 - (4) Avoid direct contact of fresh concrete with carbon dioxide emitted from poorly ventilated space heaters.

- (5) Always use ASTM approved curing compounds to insure proper curing and to prevent rapid drying and loss of moisture.
- (6) Maintain concrete at 55° F for three days (two days if ad-mixture is used). If the temperature requirements are not met, the concrete must continue to be protected until twice the deficiency in degree-days is met. For example, if the average temperature for the three days was maintained at 50° F (5° below the requirement), the concrete will need to be maintained at 65° (twice the deficiency) for an additional three days, or at 55° for an additional 6 days.

In practice, if the contractor is unable to maintain 55° F, he may also be unable to provide the increased protection requirement, three days after placement, without the use of heat generating equipment. Failure to provide the additional protection required, after first failing to provide the three days at 55° F, shall be grounds for rejecting the concrete.

Note: If the concrete is found to have frozen in the first 24 hours, it shall be rejected.

- (C) **Hot Weather Concreting.** Except by written authorization, concrete shall not be placed if the temperature of the plastic concrete cannot be maintained at ninety (90) degrees Fahrenheit or lower. The placement of concrete in hot weather shall comply with ACI 305.

9-5-9: TESTING, FINAL INSPECTION, AND ACCEPTANCE

- (A) **General.** The requirements of this section shall apply to testing services for concrete curb and gutter, sidewalk, pavement, slope paving, retaining walls, structures, and for miscellaneous concrete testing.

Concrete materials and operations shall be tested as directed by the City Engineer and as herein stipulated. The required testing services shall be performed by a testing agency approved by the City Engineer, and testing agencies shall meet the requirements of ASTM E329.

A representative of the testing agency shall inspect, sample, and test material and production of concrete as required by the City Engineer at the Responsible Party's expense. When it appears that any material furnished or work performed by the Responsible Party fails to fulfill specification requirements, the testing agency shall report such deficiency to the City Engineer and the Responsible Party.

18-Mar-04

The testing agency shall report test and inspection results to the City Engineer and Responsible Party immediately after they are performed. Test reports shall include the exact location of the work at which the batch represented by a test was deposited. The report of the strength test shall include detailed information on storage and curing of specimen prior to testing, the project number, and the location of the concrete (curb, manhole, inlet, sidewalk, paving, etc.). Test reports shall bear the seal and signature of an Engineer competent in the field of concrete testing. Reports not properly certified shall not be accepted.

The testing agency or its representative is not authorized to revoke, alter, relax, enlarge or release any requirements of these Standards and Specifications, nor approve or accept any portion of the work.

- (B) The acceptance of all concrete improvements by the City will be based on the following:
- (1) Submittal of all required test results certified by the Engineer or a qualified independent laboratory.
 - (2) Submittal of a copy of the daily inspection reports prepared by the Engineer or his representative.
 - (3) Passing a final inspection of the work by the City Engineer or his representative.
 - (4) Two sets of As-Built construction drawings shall be submitted on 24" x 36" or 22" x 34" paper or vellum in accordance with the Montrose submittal standards in Chapter 9-1. An Engineer shall stamp and sign all As-Built drawings prior to submittal. As-Built drawings shall also be submitted as an electronic AutoCAD file in accordance with the Montrose submittal standards in Chapter 9-1.
 - (5) The Responsible Party shall guarantee all portions of the work for a period of one year after completion and initial acceptance against defective workmanship and materials and shall keep the work in good repair. The determination of the necessity, during such guarantee period, for the Contractor to repair said improvement, or any portion thereof, shall rest entirely with the City Engineer, whose decision upon the matter shall be final and obligatory upon the Responsible Party.

9-5-10: FLOWCRETE/FLOWFILL SPECIFICATIONS

Flow-fill shall meet the requirements of Section 206.02(a) of the *CDOT Standard Specifications for Road and Bridge Construction*. Flow fill may be made from different ingredients and/or at different proportions than those specified in the CDOT Standard Specifications when approved by the City Engineer.


9-5-11: CONCRETE DETAILS

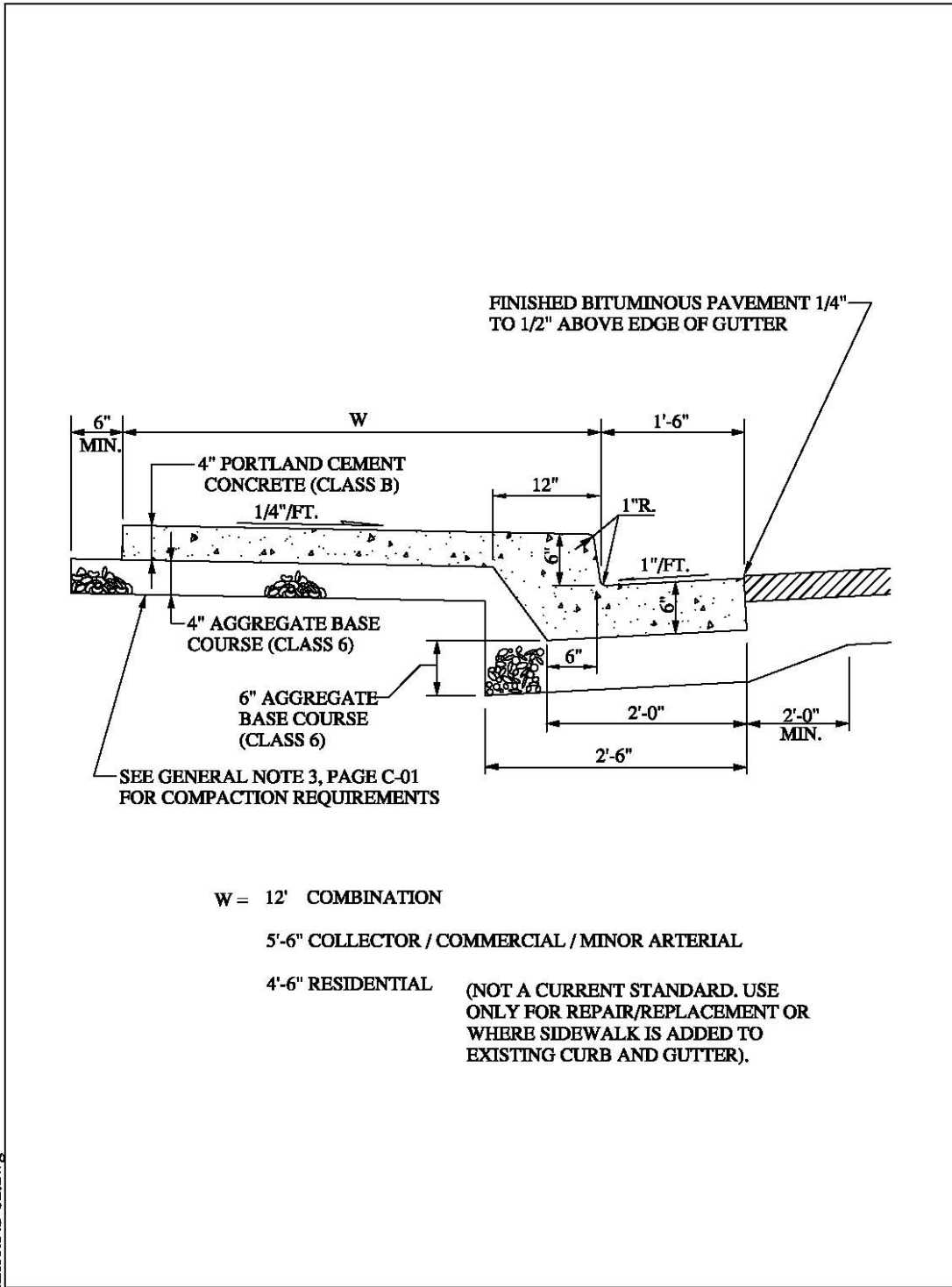
- C-01 General Notes
- C-02 Monolithic Curb, Gutter and Sidewalk
- C-03 Drive Over Curb, Gutter and Sidewalk (Residential Streets Only)
- C-04 Drive Over Curb, Gutter (Residential Streets Only)
- C-05 Curb and Gutter
- C-06 Joint Details for Curb, Gutter and Sidewalk
- C-07 Driveway Section – Detached Sidewalk
- C-08 Driveway Section – Monolithic Curb, Gutter and Sidewalk
- C-09 Driveway Section – Monolithic Curb, Gutter and Sidewalk
- C-10 Sections A and B
- C-11 Sections C and D
- C-11a Driveway Grades
- C-12 V-pan Detail and Contraction Joint Reinforcement
- C-13 Curb Ramp(s) at Intersection Sidewalk
- C-14 General Notes – Applies to All Curb Return Joint Sheets
- C-15 Curb Return Joints – 15' Radius Face of Curb
- C-16 Curb Return Joints – 20' Face of Curb
- C-17 Curb Return Joints – 25' Radius Face of Curb
- C-18 Curb Return Joints – 30' Radius Face of Curb
- C-19 Curb Return Joints – 35' Radius Face of Curb
- C-20 Sections G and H
- C-21 Alternate Ramp Without Landing
- C-22 Ramp Profile
- C-23 Ramp Detectable Warning
- C-24 Standard Accessible Parking Stall
- C-25 Parking Stall With Bumper Block
- C-26 Radii and Right-of-way Width at Intersection Corner
- C-27 Asphalt Patching For Replacement or Addition of Curb, Gutter and Sidewalk
- C-28 Joint Seal
- C-29 Joint Details For Concrete Pavement
- C-30 Longitudinal Joints For Concrete Pavement
- C-31 Mail Box Installation
- C-32 Patching Concrete Pavement

1. ALL PORTLAND CEMENT CONCRETE SHALL BE COLORADO DEPARTMENT OF TRANSPORTATION CLASS "B". ALL CONCRETE SHALL BE MIXED, PLACED, CURED AND TESTED IN ACCORDANCE WITH CITY OF MONTROSE STANDARD SPECIFICATIONS FOR CONSTRUCTION, WITHIN PUBLIC RIGHTS-OF-WAY.
2. A CITY STREET CUT PERMIT IS REQUIRED AT EACH LOCATION WHERE CONCRETE IS REMOVED, ALTERED OR PLACED.
3. ALL CURBS, GUTTERS, SIDEWALKS, DRIVEWAYS, RAMPS, DRAINAGE PANS AND OTHER CONCRETE WORK SHALL BE UNDERLAID WITH AGGREGATE BASE COURSE (CLASS 6) COMPACTED TO AT LEAST 95% OF AASHTO T-180 MAXIMUM DENSITY. SEE DETAILS FOR BASE THICKNESS. THE TOP 6 INCHES OF SUBGRADE UNDER ALL CONCRETE SHALL BE COMPACTED TO AT LEAST 90% OF AASHTO T-180 MAXIMUM DENSITY. ALL SATURATED OR UNSTABLE SUBGRADE MATERIAL SHALL BE REMOVED AND REPLACED WITH SUITABLE MATERIAL.
4. ALL EXISTING PAVEMENT NOT DESIGNATED FOR REMOVAL WHICH IS DAMAGED BY CONSTRUCTION SHALL BE REPLACED IN-KIND BY CONTRACTOR.
5. ALL DRIVEWAY CONCRETE (APRON AND SIDEWALK CROSSING) SHALL BE 6 INCHES THICK (MIN.) FOR RESIDENTIAL USES AND 8" THICK (MIN.) FOR ALL OTHER USES.
6. TRANSVERSE EXPANSION JOINTS SHALL BE PROVIDED IN ALL CONCRETE CURBS, GUTTERS, SIDEWALKS AND TRAILS, ETC., AT ENDS OF HORIZONTAL CURVES AND AT SPACING SHOWN ON PAGE C-06. TRANSVERSE CONTRACTION JOINTS SHALL BE PROVIDED AT 10' SPACING.
7. VEHICULAR TRAFFIC SHALL BE KEPT OFF NEW CONCRETE FOR A MINIMUM OF FIVE DAYS OR UNTIL THE CONCRETE REACHES A COMPRESSIVE STRENGTH OF 2500 PSI.
8. AN APPROVED CURING/SEALING COMPOUND SHALL BE APPLIED TO ALL EXPOSED CONCRETE IMMEDIATELY AFTER FINISHING. APPROVED COMPOUNDS INCLUDE SAFE CURE AND SEAL AND DAY-CHEM CURE AND SEAL MANUFACTURED BY DAYTON SUPERIOR.
9. UNDER NO CIRCUMSTANCES SHALL WATER BE ADDED TO CONCRETE SURFACES DURING FINISHING OPERATIONS.
10. HANDICAP RAMPS SHALL BE INSTALLED AT EACH CORNER OF ALL STREET INTERSECTIONS. SEE PAGES C-12 THROUGH C-22 FOR DETAILS.
11. "CONTROL JOINT" SHALL HAVE THE SAME MEANING AS "CONTRACTION JOINT".
12. SEE PAGE C-32 FOR CONCRETE PAVEMENT PATCHING DETAIL.

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GENERAL NOTES

 <p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD CONCRETE DETAILS</p>	<p>APPROVED: <u>SAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>ELR</u></p>	<p>PAGE C-01</p>
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W = 12' COMBINATION

5'-6" COLLECTOR / COMMERCIAL / MINOR ARTERIAL

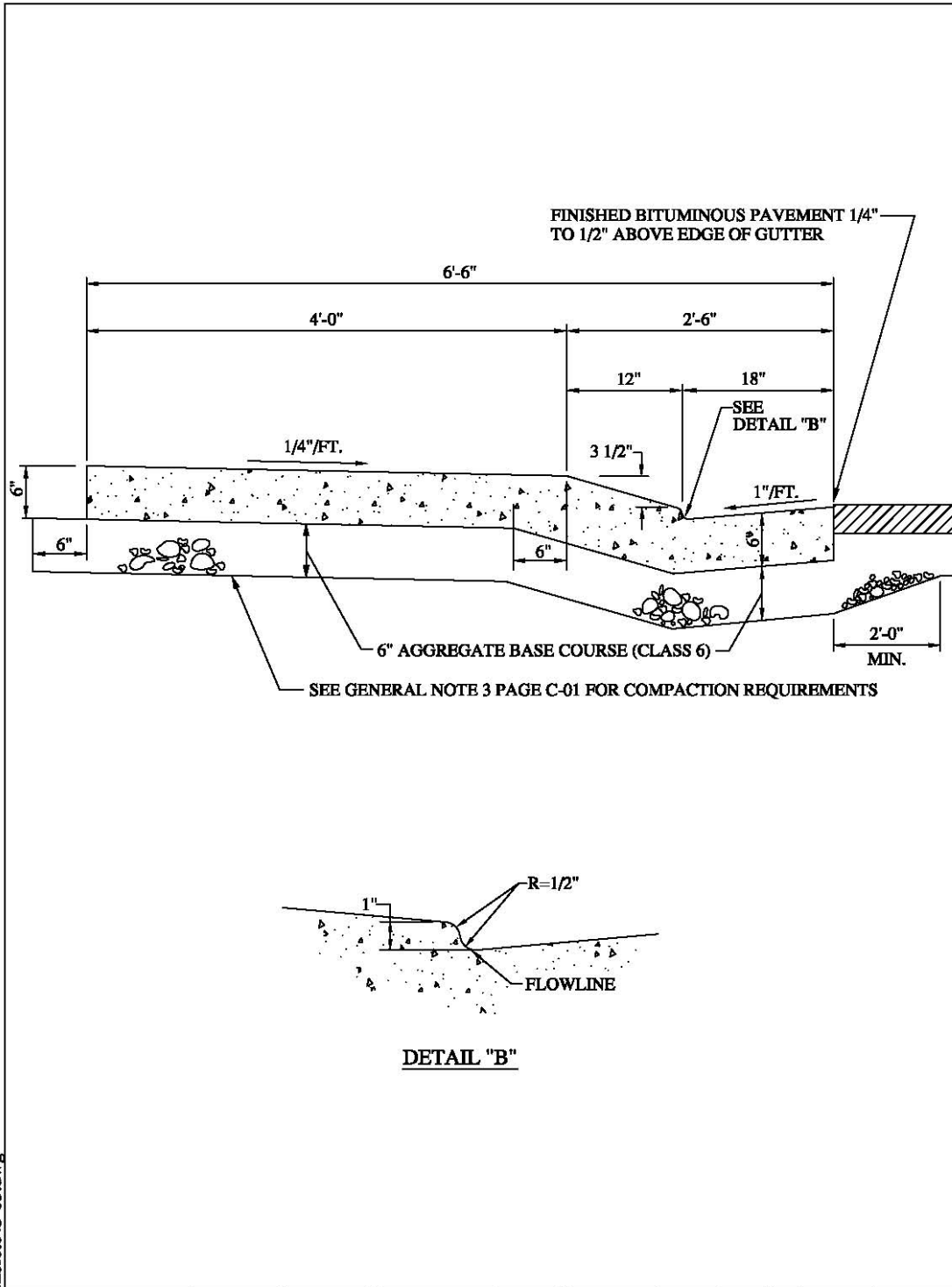
4'-6" RESIDENTIAL

(NOT A CURRENT STANDARD. USE ONLY FOR REPAIR/REPLACEMENT OR WHERE SIDEWALK IS ADDED TO EXISTING CURB AND GUTTER).

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MONOLITHIC CURB, GUTTER AND SIDEWALK

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DRIVE OVER CURB, GUTTER AND SIDEWALK (RES. ONLY)

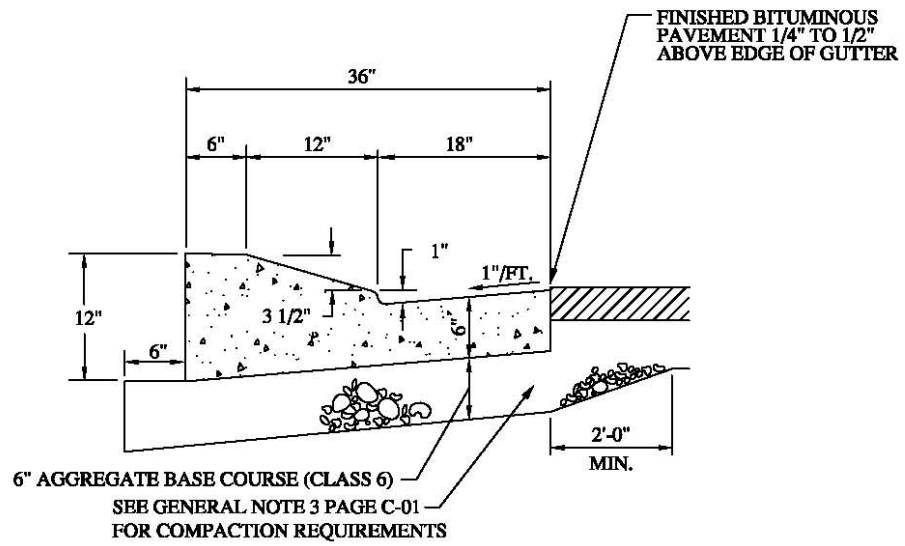


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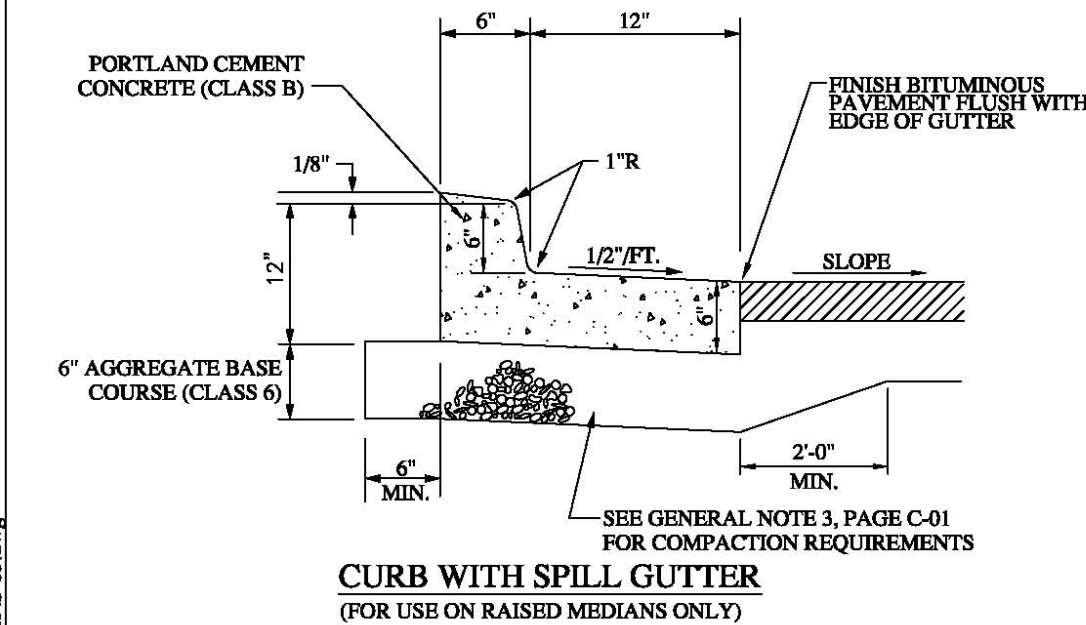
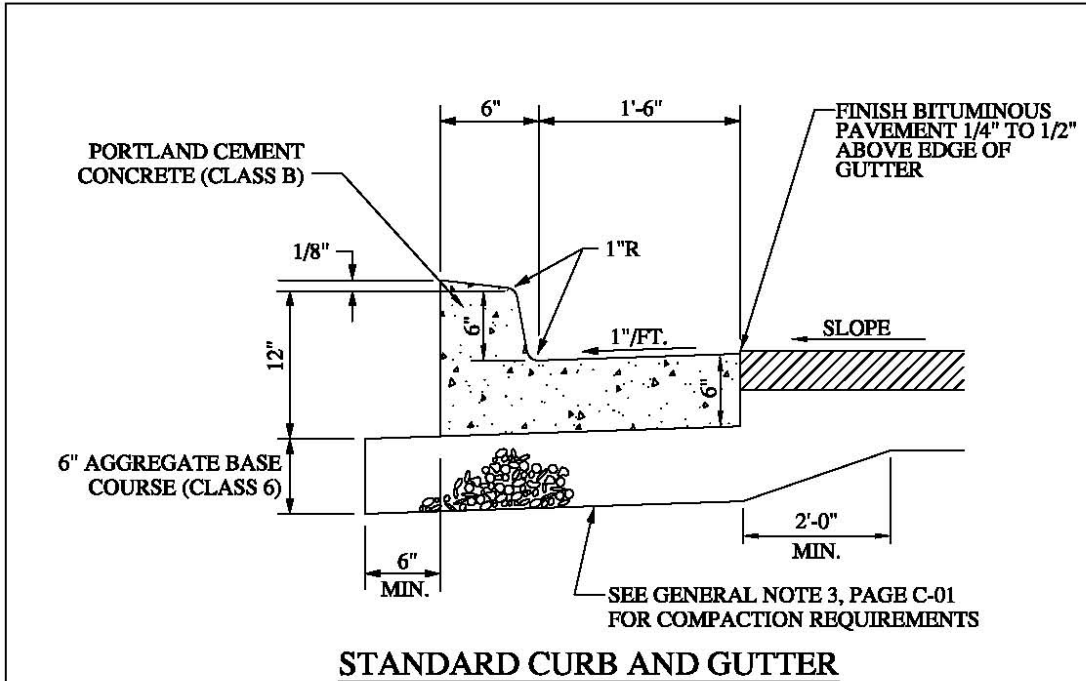
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DRIVE OVER CURB AND GUTTER (RES. ONLY)

 CITY OF MONTROSE	PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT	STANDARD CONCRETE DETAILS	APPROVED: <u>YLR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>YLR</u>	PAGE C-04
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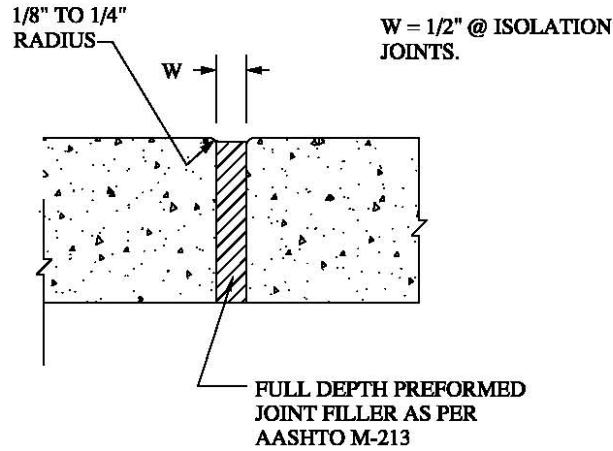
CURB AND GUTTER

<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT</p>	<p>STANDARD CONCRETE DETAILS</p>	<p>APPROVED: <u>LAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>ELR</u></p>	<p>PAGE C-05</p>
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EXPANSION JOINT SPACING

HAND FORMED FLATWORK = 100' MAX

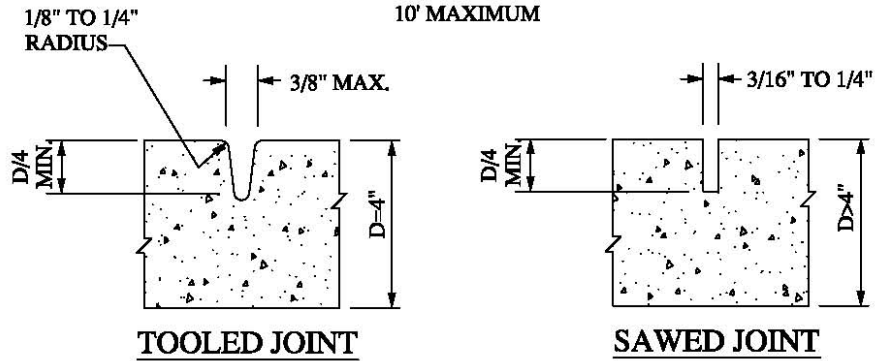
SLIP FORMED FLATWORK = 200' MAX



UNDOWELED EXPANSION OR ISOLATION JOINT

CONTRACTION JOINT SPACING

5' MINIMUM
10' STANDARD
10' MAXIMUM

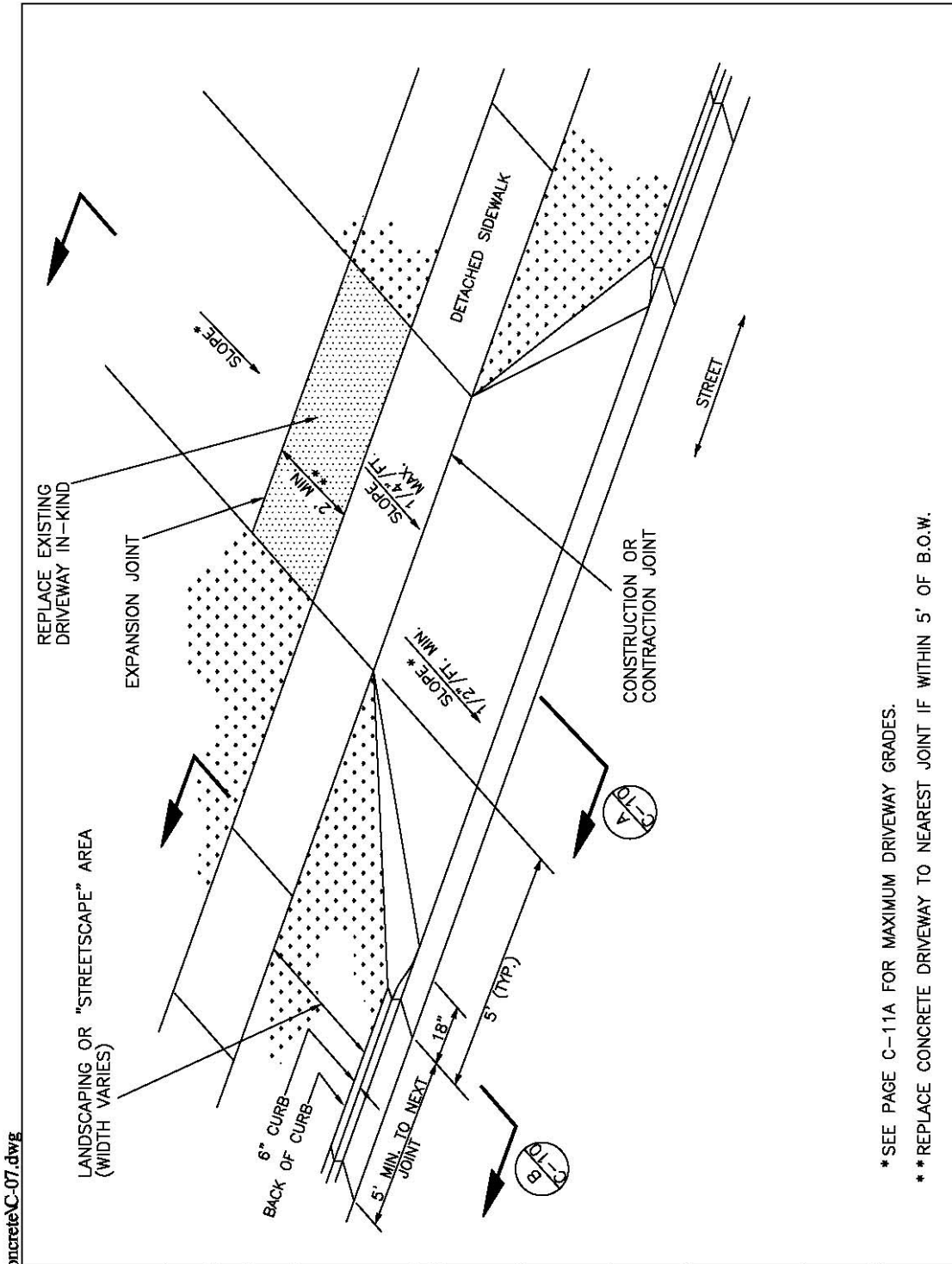


TRANSVERSE CONTROL JOINTS

JOINT DETAILS FOR CURB, GUTTER AND SIDEWALK

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 <p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD CONCRETE DETAILS</p>	<p>APPROVED: <u>LLR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>LLR</u></p>	<p>PAGE C-06</p>
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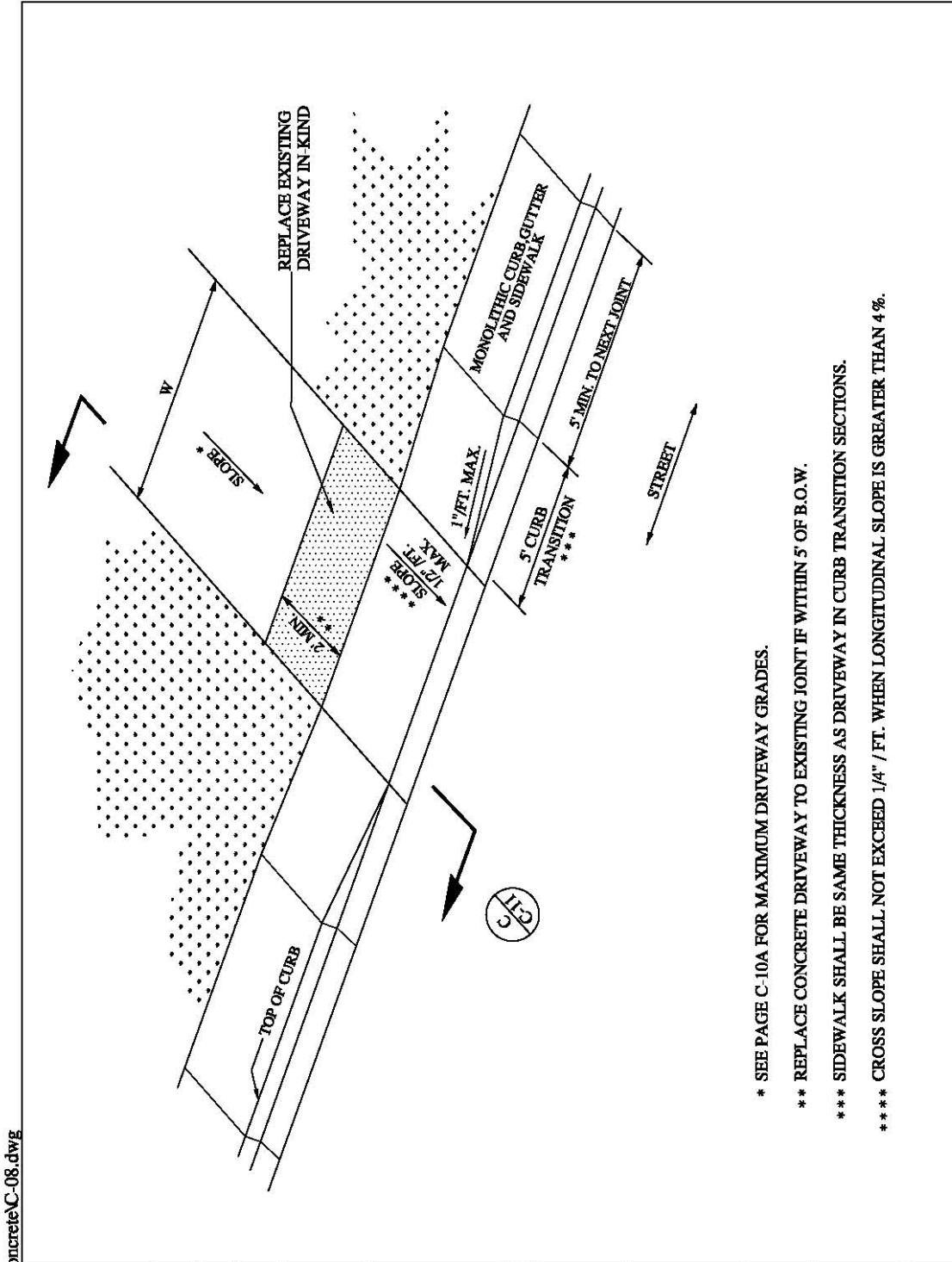


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* SEE PAGE C-11A FOR MAXIMUM DRIVEWAY GRADES.
 ** REPLACE CONCRETE DRIVEWAY TO NEAREST JOINT IF WITHIN 5' OF B.O.W.

DRIVEWAY SECTION - DETACHED SIDEWALK, GUTTER AND CURB

<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD CONCRETE DETAILS</p>	<p>APPROVED: <u>LAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>SLR</u></p>	<p>PAGE C-07</p>
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* SEE PAGE C-10A FOR MAXIMUM DRIVEWAY GRADES.

** REPLACE CONCRETE DRIVEWAY TO EXISTING JOINT IF WITHIN 5' OF B.O.W.

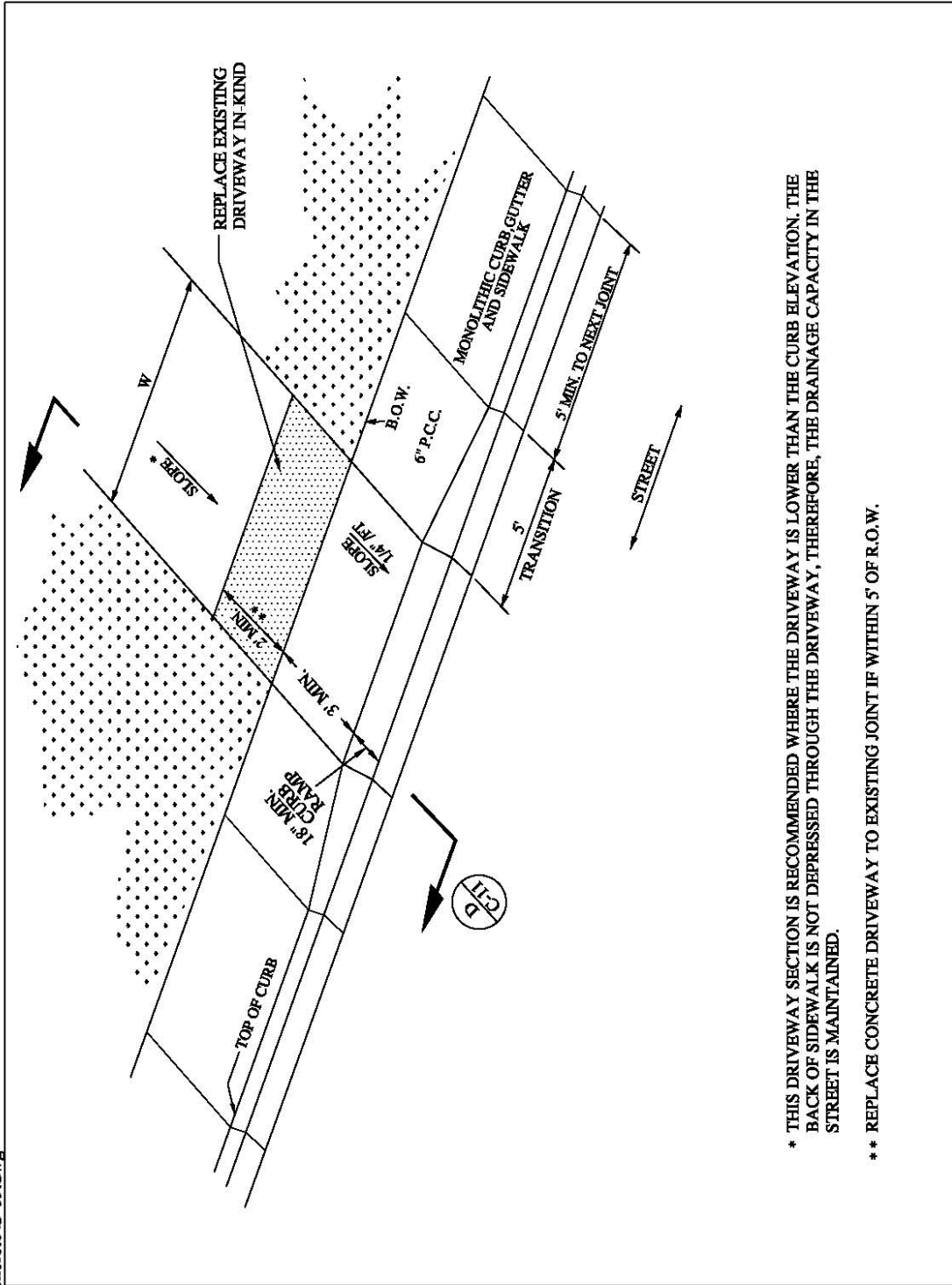
*** SIDEWALK SHALL BE SAME THICKNESS AS DRIVEWAY IN CURB TRANSITION SECTIONS.

**** CROSS SLOPE SHALL NOT EXCEED 1/4" / FT. WHEN LONGITUDINAL SLOPE IS GREATER THAN 4%.

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DRIVEWAY SECTION - MONOLITHIC CURB, GUTTER AND SIDEWALK

<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD CONCRETE DETAILS</p>	<p>APPROVED: <u>LAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>ELR</u></p>	<p>PAGE C-08</p>
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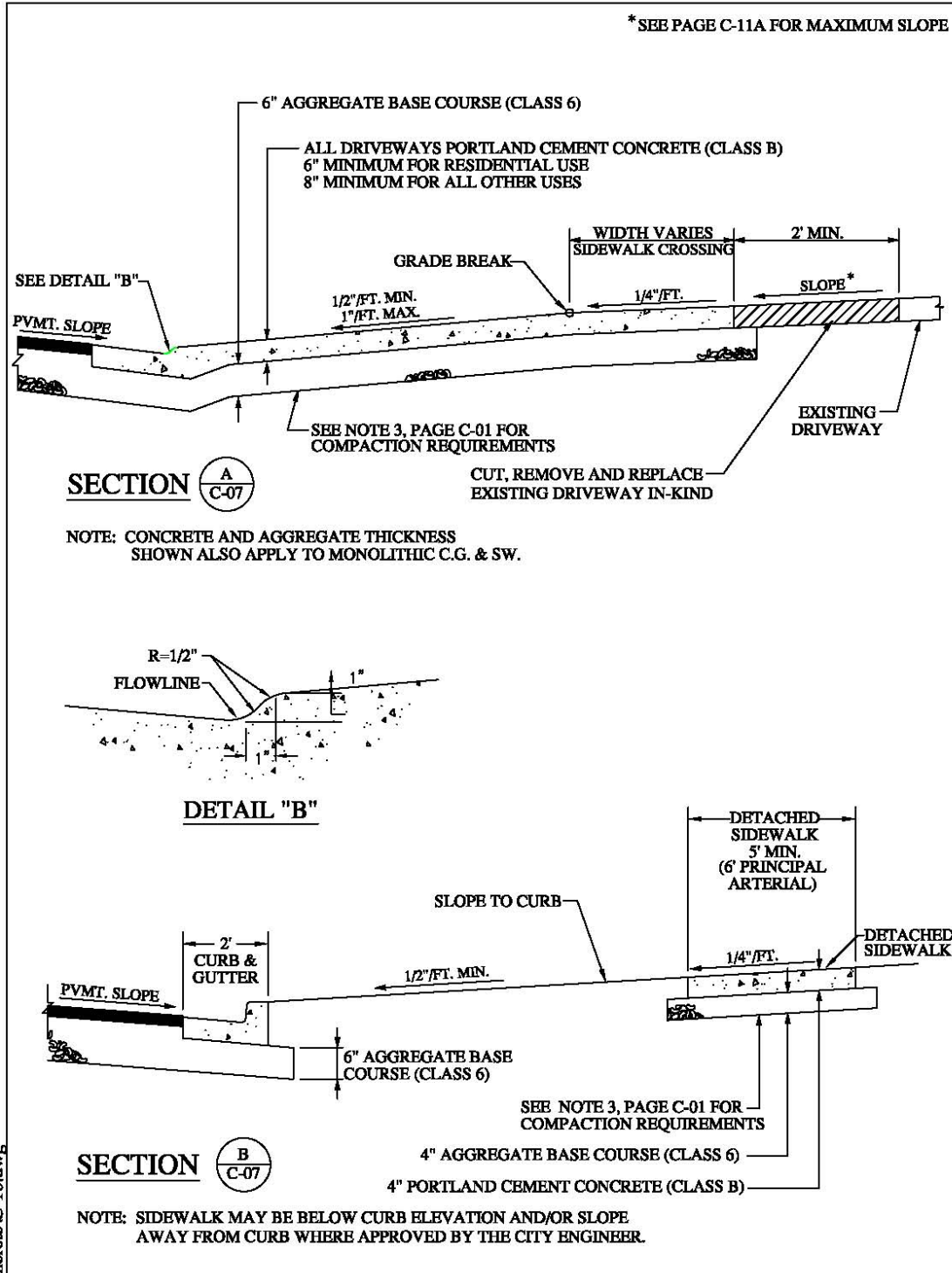
* THIS DRIVEWAY SECTION IS RECOMMENDED WHERE THE DRIVEWAY IS LOWER THAN THE CURB ELEVATION. THE BACK OF SIDEWALK IS NOT DEPRESSED THROUGH THE DRIVEWAY, THEREFORE, THE DRAINAGE CAPACITY IN THE STREET IS MAINTAINED.

** REPLACE CONCRETE DRIVEWAY TO EXISTING JOINT IF WITHIN 5' OF R.O.W.

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DRIVEWAY SECTIONS-MONOLITHIC CURB, GUTTER AND SIDEWALK

<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD CONCRETE DETAILS</p>	<p>APPROVED: <u>SAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>CLR</u></p>	<p>PAGE C-09</p>
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SECTIONS A AND B

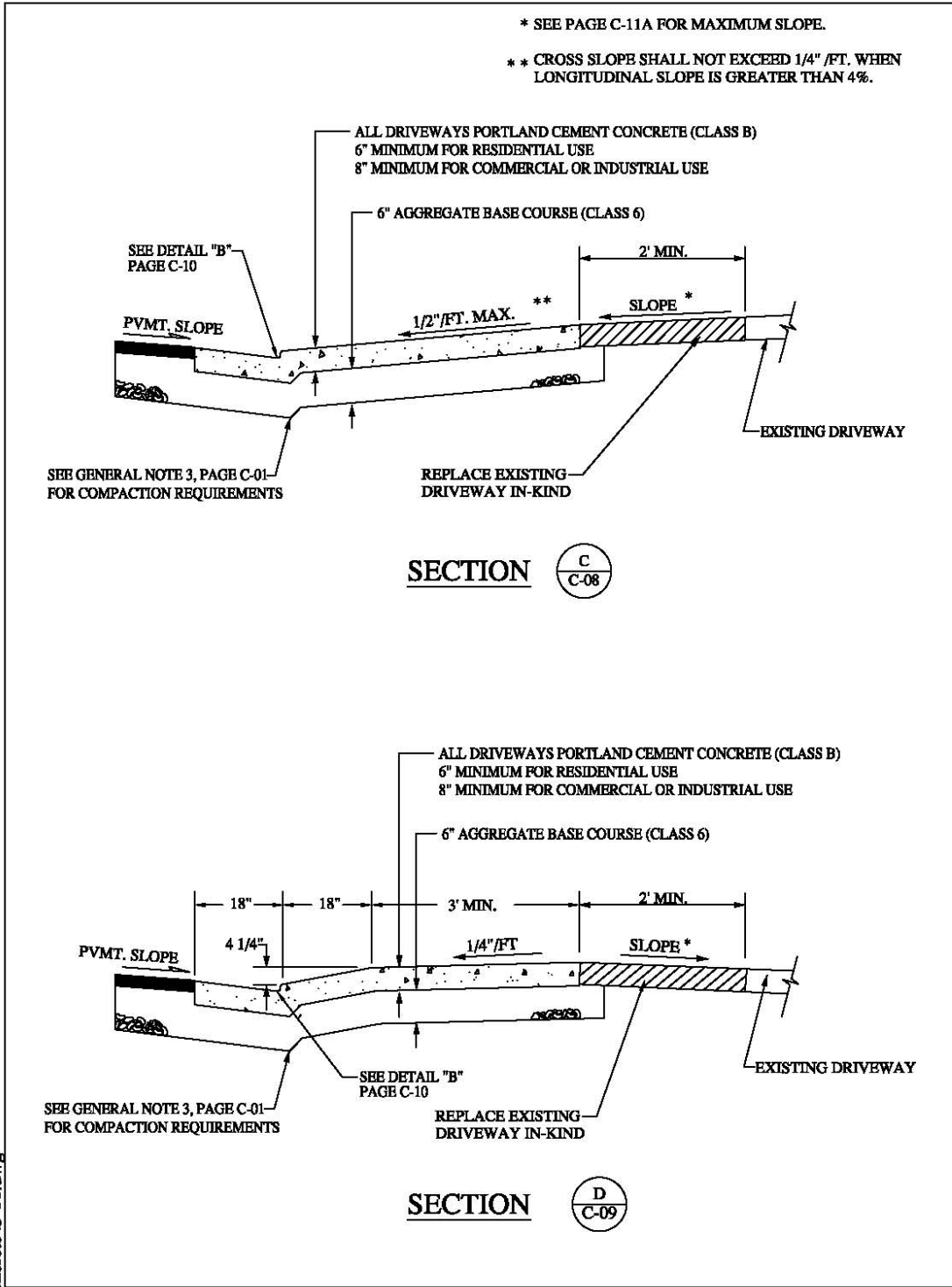


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SECTIONS C AND D

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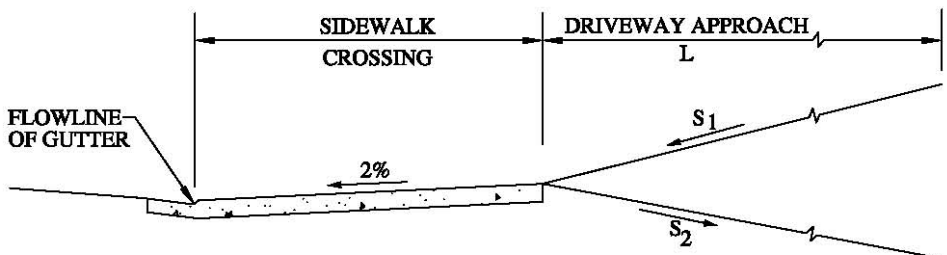



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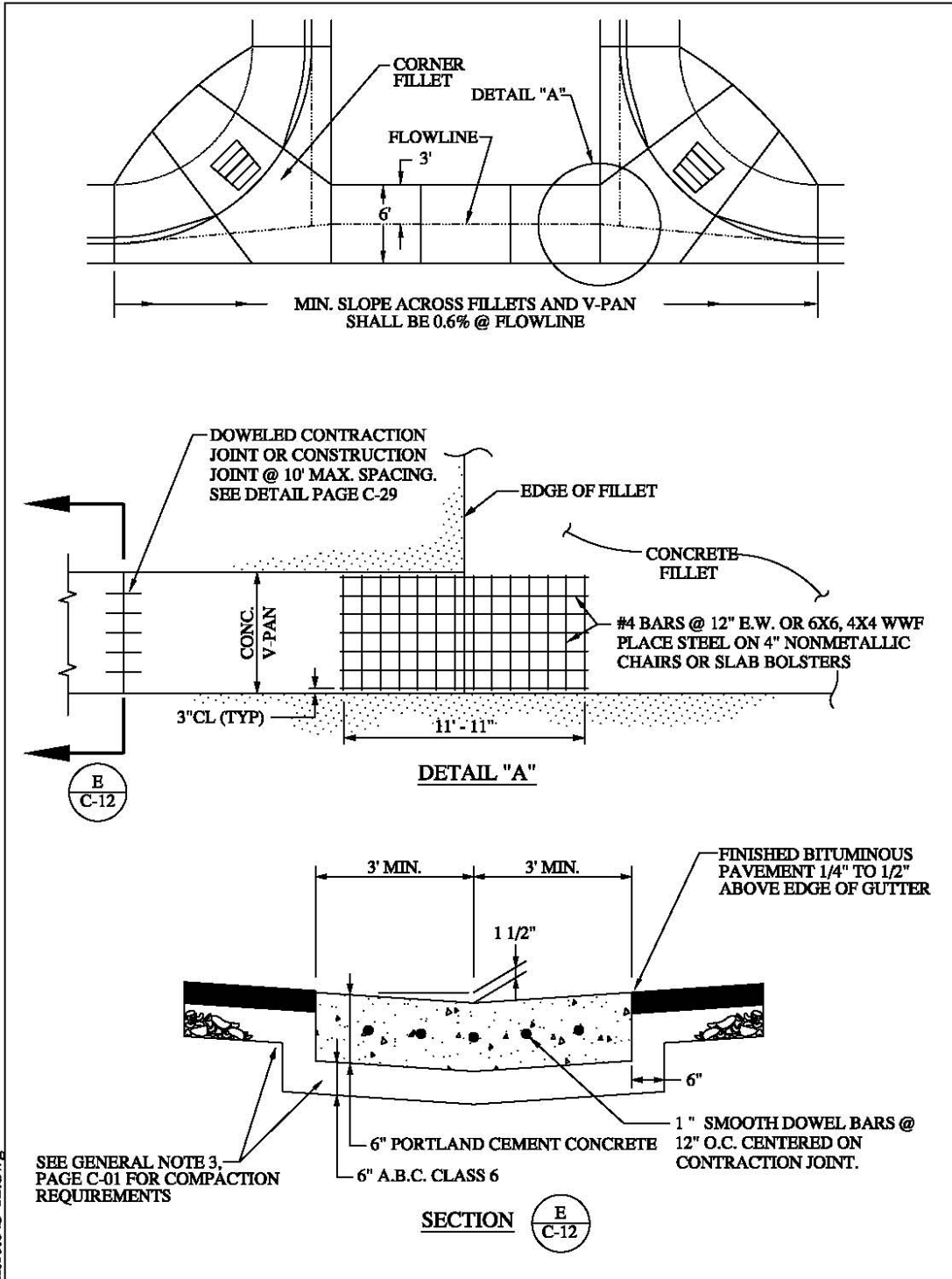
STANDARD CONCRETE
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PAGE
C-11

MAXIMUM DRIVEWAY APPROACH GRADES				
ROADWAY CLASS	DRIVEWAY TYPE			
	RESIDENTIAL		OTHER THAN RESIDENTIAL	
	S ₁	S ₂	S ₁	S ₂
OTHER THAN RESIDENTIAL	8%	4%	6%	4%
RESIDENTIAL	14%	6%	6%	4%
<p>NOTE: STEEPER DRIVEWAY APPROACH MAY BE APPROVED WHERE REQUIRED TO MATCH EXISTING CONDITIONS.</p>				
MINIMUM LENGTH OF APPROACH @ MAXIMUM GRADE				
ROADWAY CLASS	DRIVEWAY TYPE			
	RESIDENTIAL		OTHER THAN RESIDENTIAL	
	L		L	
OTHER THAN RESIDENTIAL	16.5'		33'	
RESIDENTIAL	13'		26'	
 <p style="text-align: center;">DRIVEWAY APPROACH GRADES</p>				
DRIVEWAY GRADES				
 <p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION</p> <p>QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD CONCRETE DETAILS</p>	<p>APPROVED: <u>LAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>ELR</u></p>	<p>PAGE C-11a</p>

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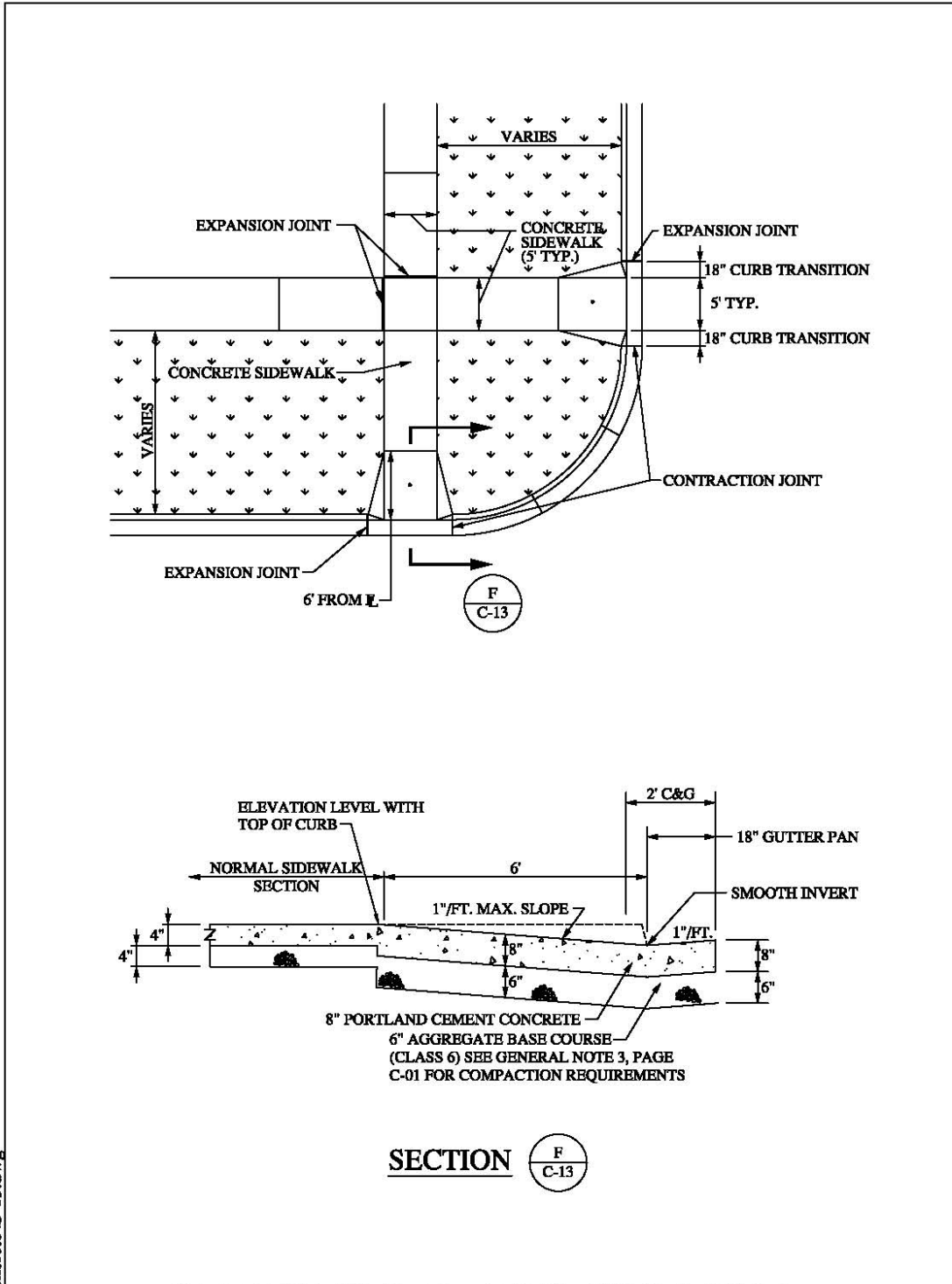


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SEE GENERAL NOTE 3, PAGE C-01 FOR COMPACTION REQUIREMENTS

V-PAN DETAIL AND CONTRACTION JOINT REINFORCEMENT

<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD CONCRETE DETAILS</p>	<p>APPROVED: <u>SAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>CLR</u></p>	<p>PAGE C-12</p>
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CURB RAMP(S) AT INTERSECTION SIDEWALK

<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT</p>	<p>STANDARD CONCRETE DETAILS</p>	<p>APPROVED: <u>SLR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>SLR</u></p>	<p>PAGE C-13</p>
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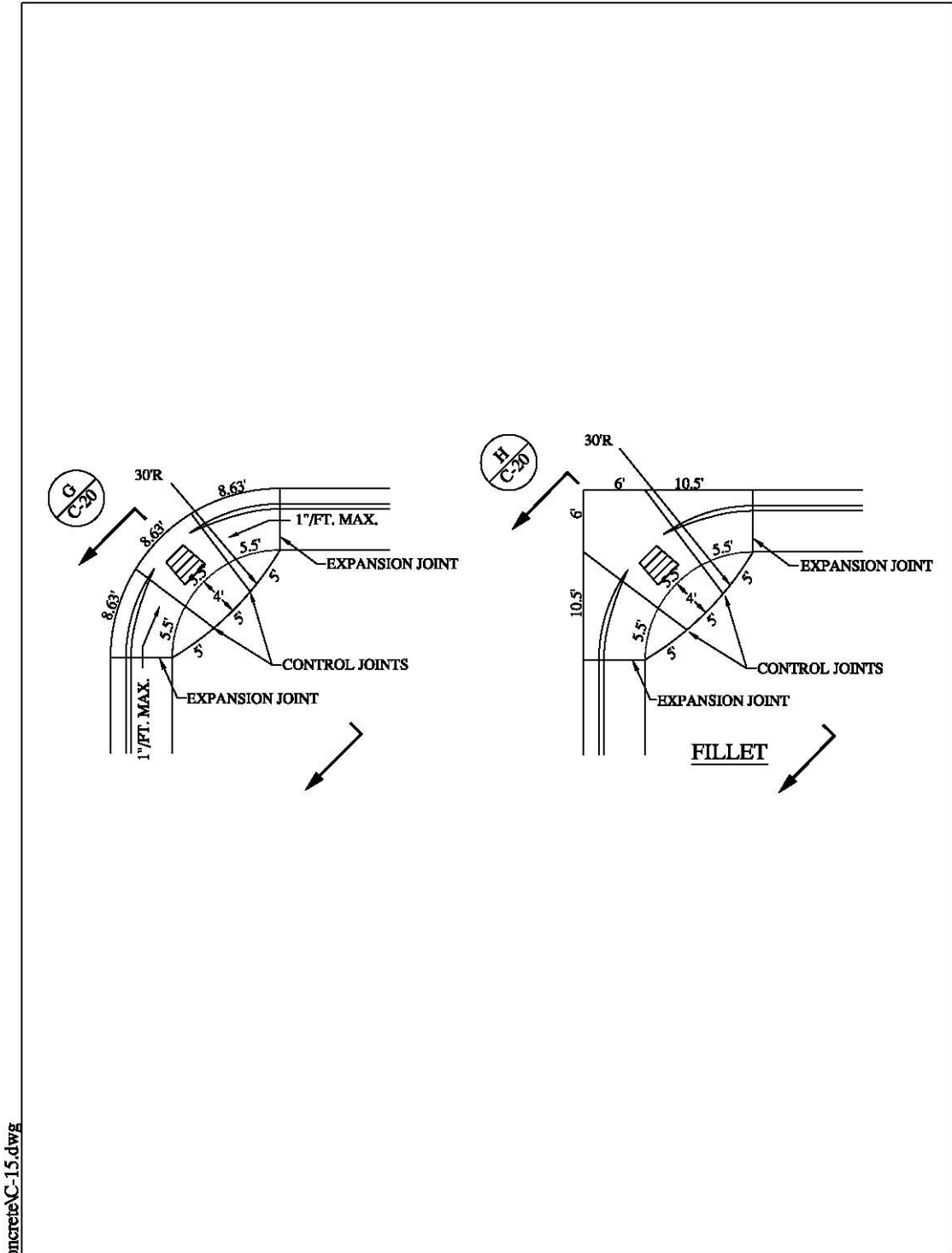
THE FOLLOWING NOTES APPLY TO PAGES C-15 THROUGH C-24

- 1.) CONCRETE WITHIN CORNER RADIUS SHALL BE 6" THICK FROM CURB RETURN TO CURB RETURN INCLUDING THE FILLET, CURB GUTTER AND SIDEWALK, LANDING AND RAMP.
- 2.) A 4' WIDE LANDING SHALL BE INSTALLED BEHIND EACH CURB RAMP UNLESS OTHERWISE SPECIFIED OR APPROVED. SEE PAGE C-21 FOR ALTERNATE RAMP WITHOUT LANDING.
- 3.) LINES SHOWING CURB AND GUTTER AND DIMENSIONAL BACK OF WALK ARE FOR DESIGN PURPOSES ONLY AND NOT JOINT PATTERNS. CONTRACTION JOINTS ARE SHOWN AS DASHED LINES ON EACH DETAIL.
- 4.) SEE SHEET C-13 AND C-20 FOR SLOPE ON RAMPS.
- 5.) RAMP OPENING WIDTH AT FLOWLINE GUTTER SHALL BE 5'.
- 6.) CONTROL JOINT SHALL HAVE THE SAME MEANING AS CONTRACTION JOINT.

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GENERAL NOTES-APPLIES TO ALL CURB RETURN JOINT SHEETS

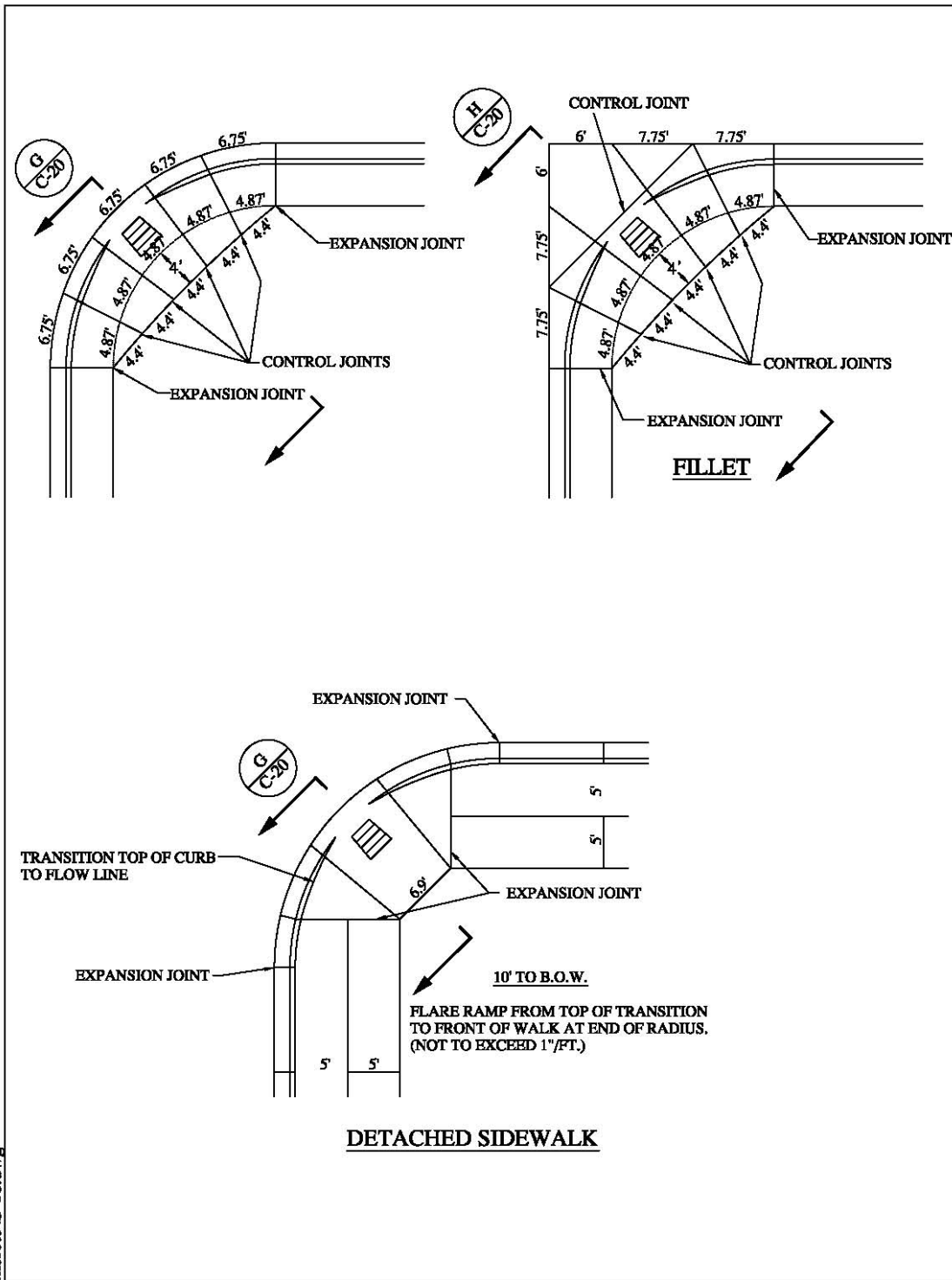
 <p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT</p>	<p>STANDARD CONCRETE DETAILS</p>	<p>APPROVED: <u>SLR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>SLR</u></p>	<p>PAGE C-14</p>
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CURB RETURN JOINTS-15' RADIUS FACE OF CURB

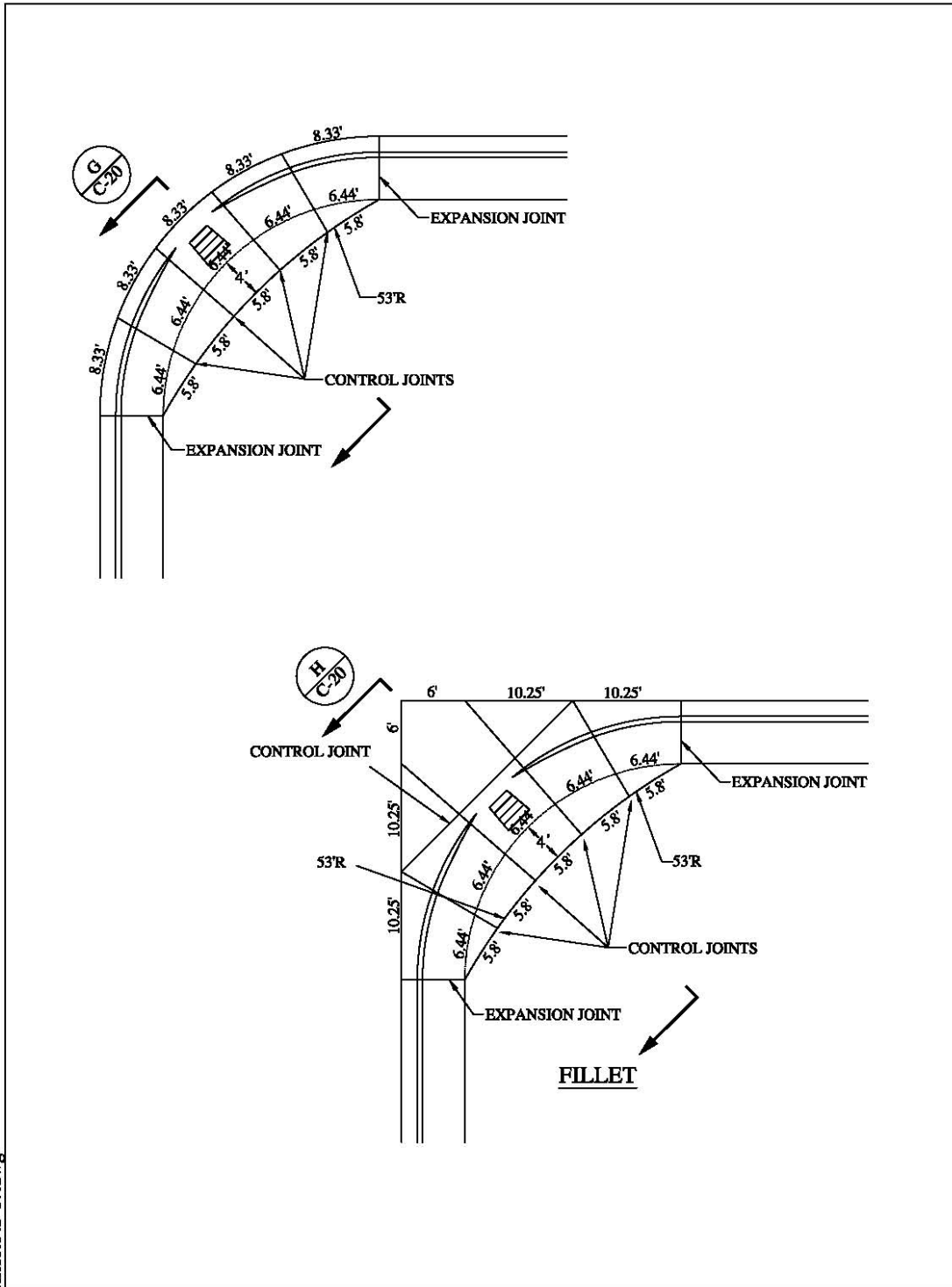
<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD CONCRETE DETAILS</p>	<p>APPROVED: <u>LAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>ELR</u></p>	<p>PAGE C-15</p>
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CURB RETURN JOINTS-20' RADIUS FACE OF CURB

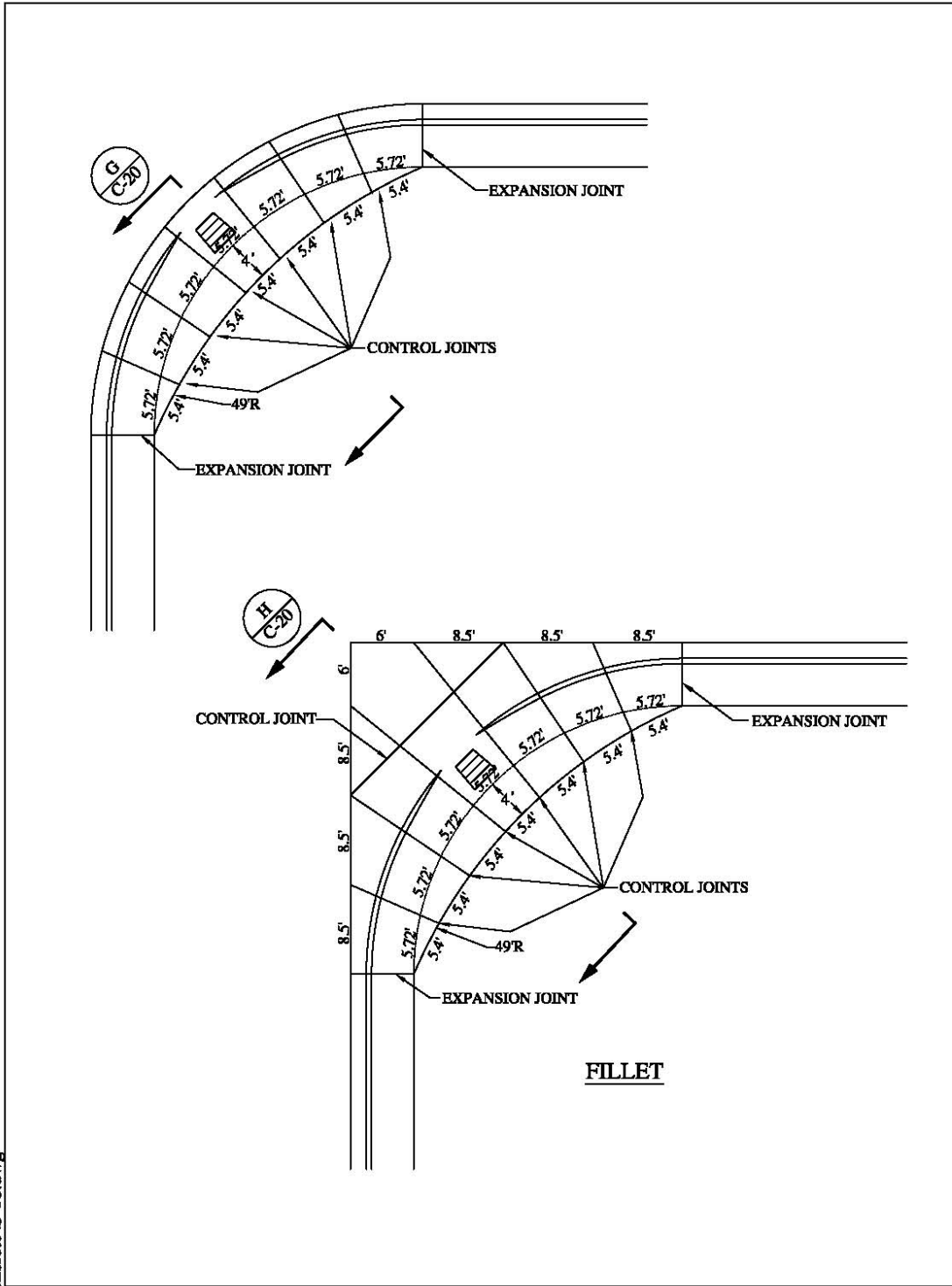
<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD CONCRETE DETAILS</p>	<p>APPROVED: <u>L.R.</u> REV: <u>JULY 2003</u> DRAWN BY: <u>L.R.</u></p>	<p>PAGE C-16</p>
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CURB RETURN JOINTS-25' RADIUS FACE OF CURB

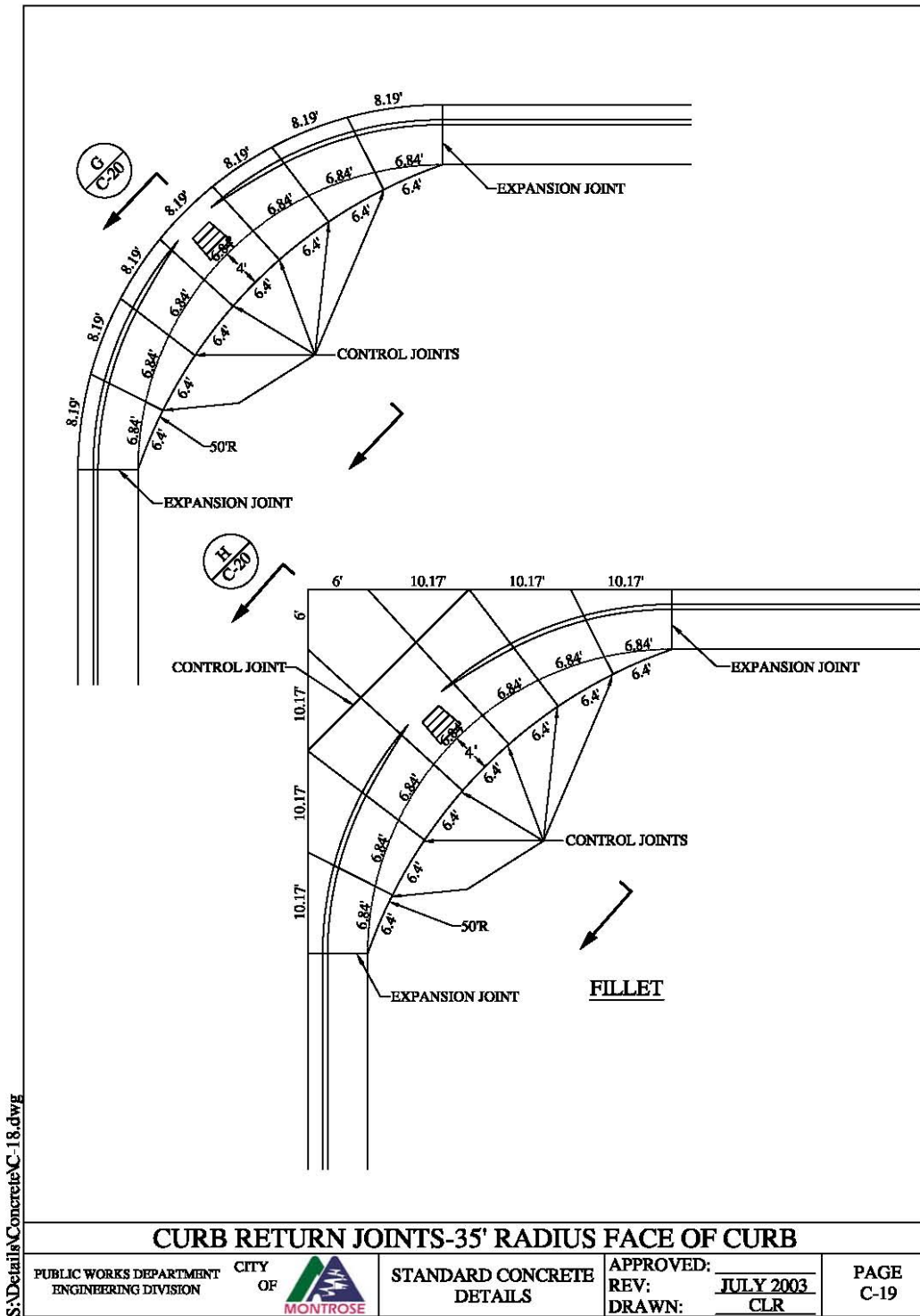
PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION	CITY OF  MONTROSE	STANDARD CONCRETE DETAILS	APPROVED: REV: <u>JULY 2003</u> DRAWN: <u>CLR</u>	PAGE C-17
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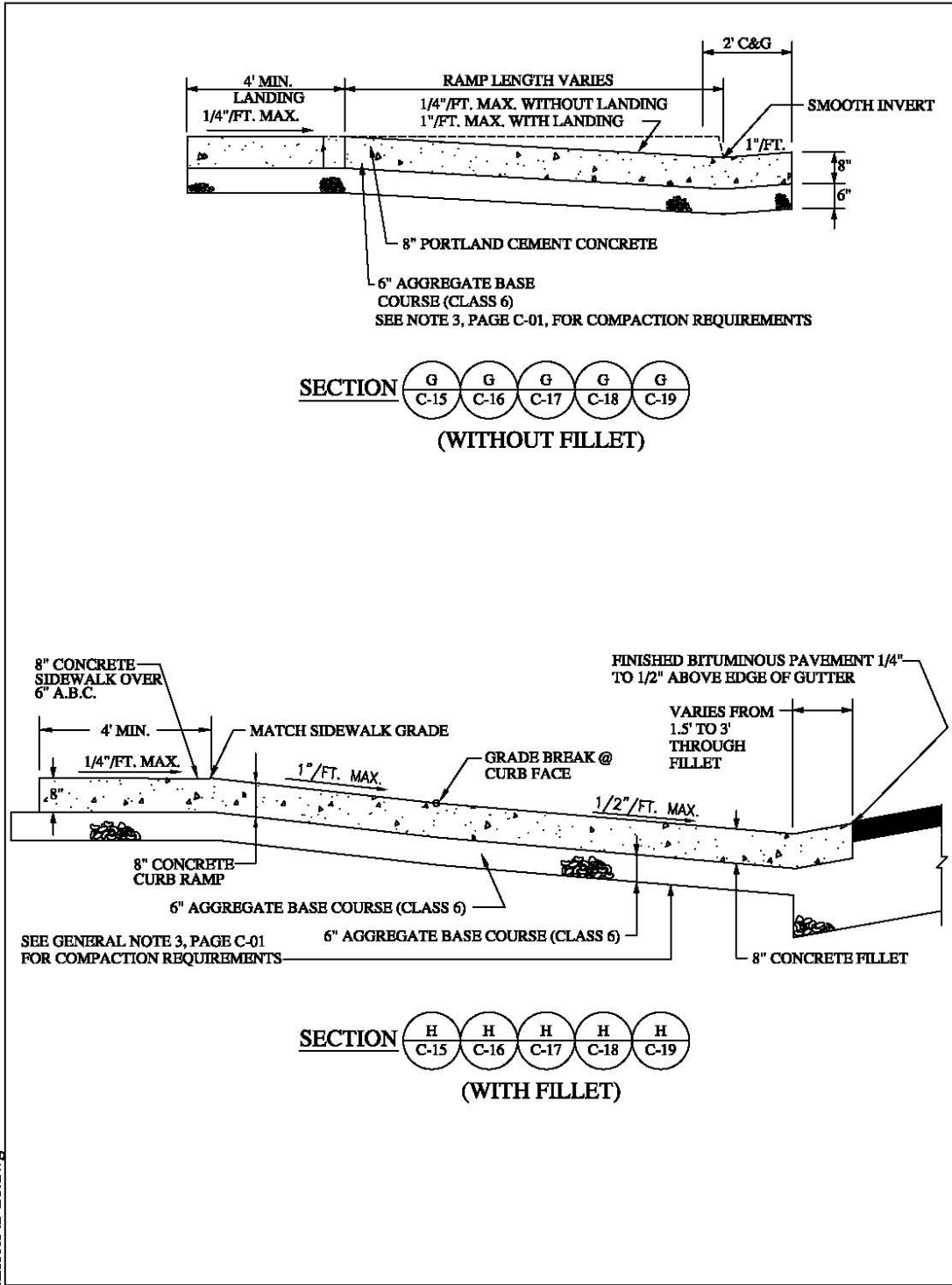


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CURB RETURN JOINTS-30' RADIUS FACE OF CURB

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SECTIONS G AND H



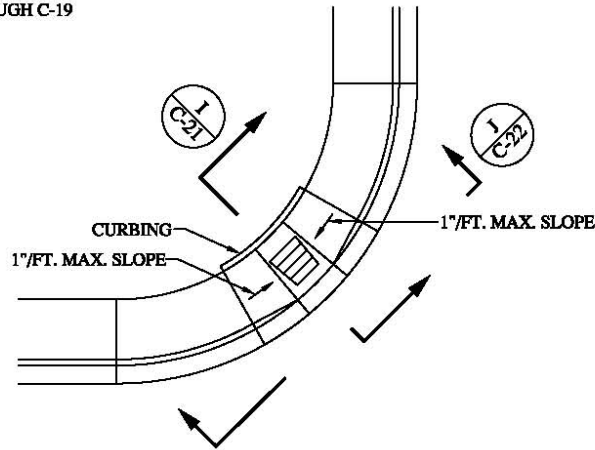
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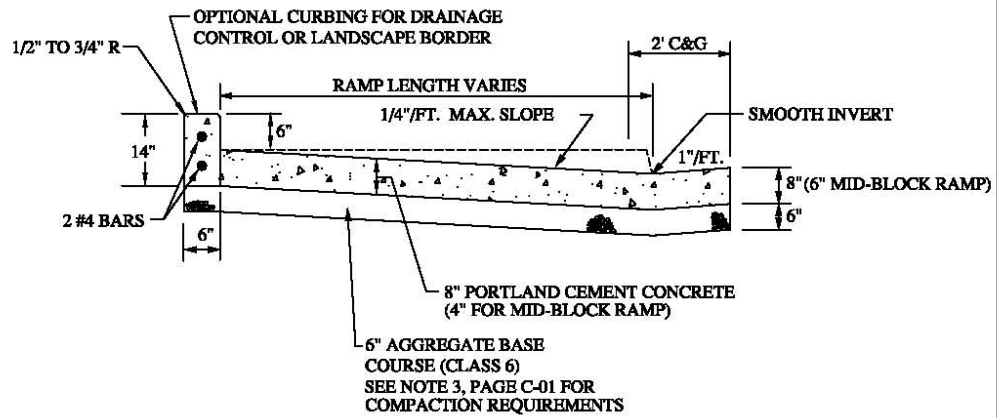
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DRAWN BY: SLR

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NOTE:
FOR JOINT DETAILS, SEE
SHEETS C-13 THROUGH C-19



WITHOUT LANDING BEHIND RAMP
(FOR RETROFIT ON EXISTING STREETS ONLY)



SECTION I
C-21

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ALTERNATE RAMP WITHOUT LANDING

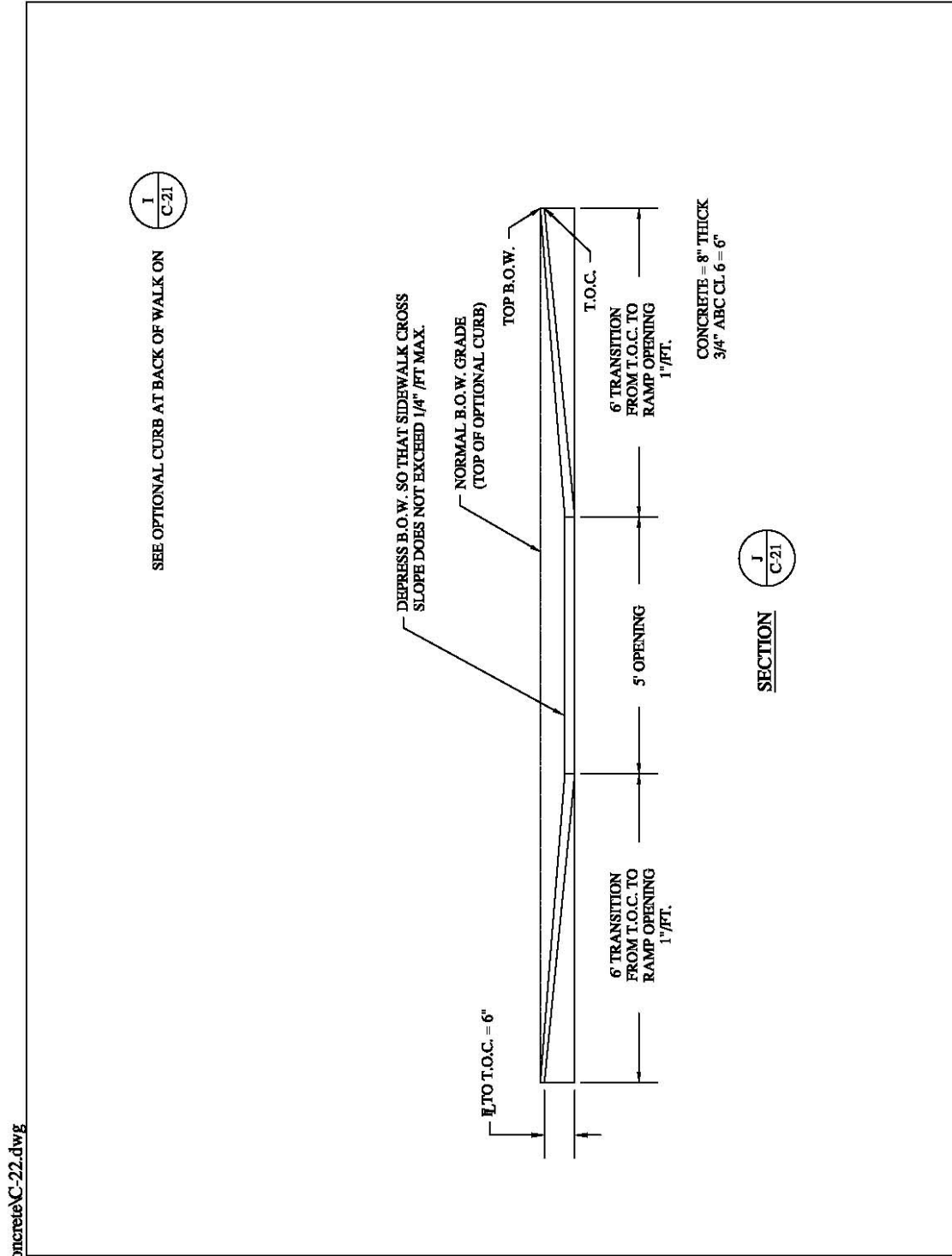


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I
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SEE OPTIONAL CURB AT BACK OF WALK ON

J
C-21

SECTION

RAMP PROFILE

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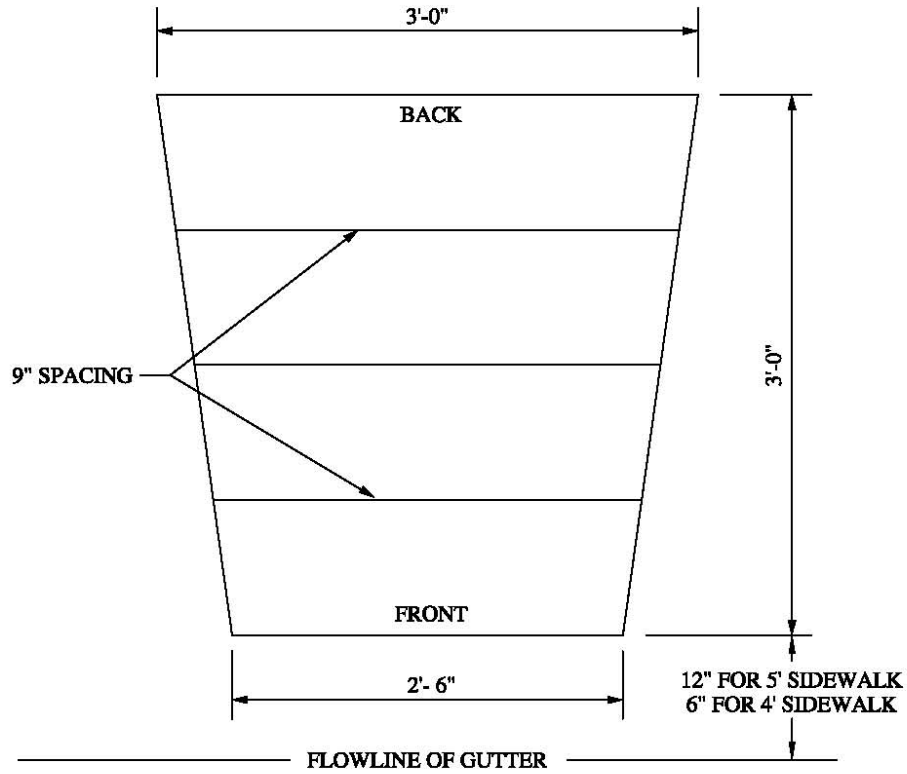


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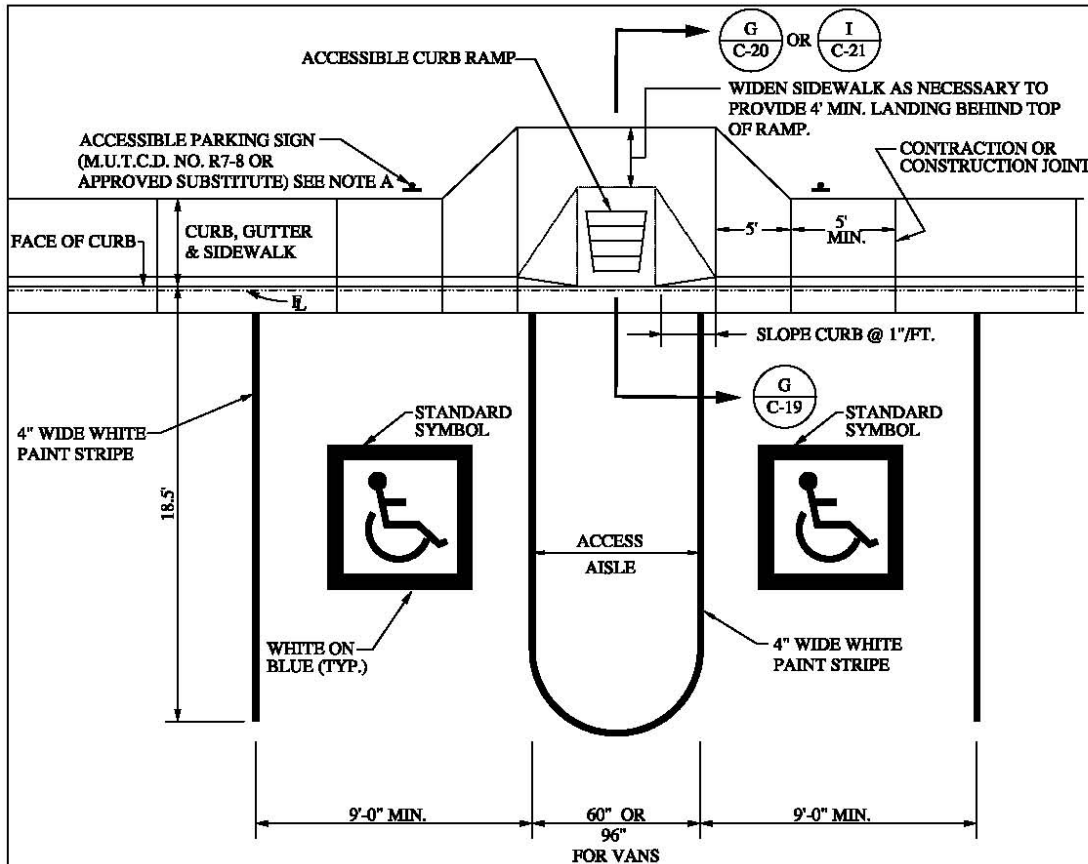
NOTE
GROOVES IN PATTERN ARE TOOLED OR SAW CUT 1/4" MAX. DEPTH X 1/2" MAX. WIDTH.

CENTER DETECTABLE WARNING IN RAMP.

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RAMP DETECTABLE WARNING

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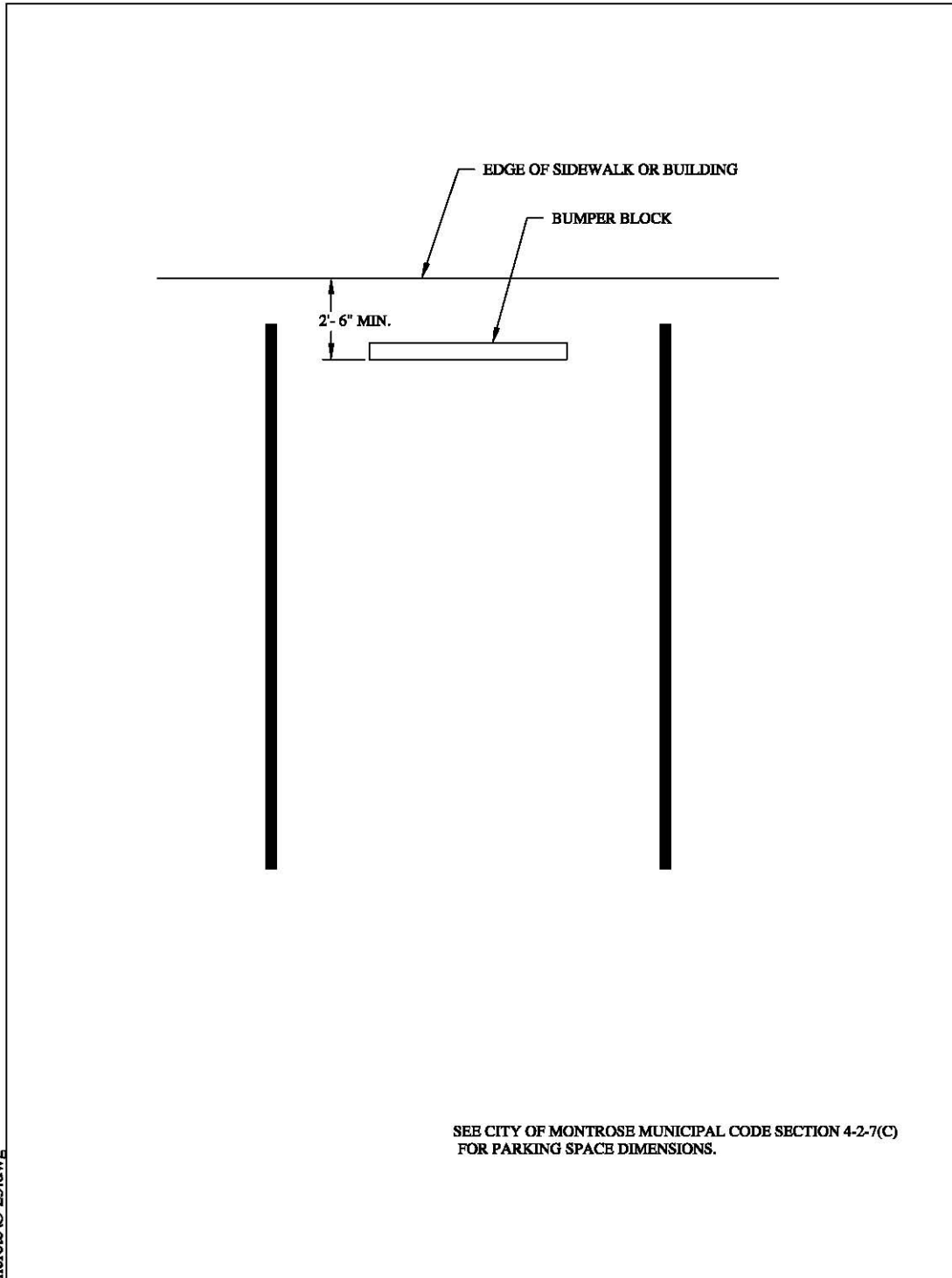
NOTES:

- A. ACCESSIBLE PARKING SPACES SHALL BE DESIGNATED AS RESERVED FOR THE DISABLED BY A SIGN SHOWING THE SYMBOL OF ACCESSIBILITY (SEE UFAS 4.30.5). SPACES COMPLYING WITH NOTE B SHALL HAVE AN ADDITIONAL SIGN "VAN ACCESSIBLE" MOUNTED BELOW THE SYMBOL OF ACCESSIBILITY. SUCH SIGNS SHALL BE MOUNTED SO THEY CANNOT BE OBSCURED BY A VEHICLE PARKED IN THE SPACE.
- B. ONE IN EVERY EIGHT ACCESSIBLE SPACES, BUT NOT LESS THAN ONE, SHALL BE SERVED BY AN ACCESS AISLE 9'-0" WIDE AND SHALL BE DESIGNATED "VAN ACCESSIBLE" AS SPECIFIED BY NOTE A.
- C. PARKING ACCESS AISLES SHALL BE PART OF AN ACCESS ROUTE TO THE BUILDING OR FACILITY ENTRANCE. TWO ACCESSIBLE PARKING SPACES MAY SHARE A COMMON ACCESS AISLE. PARKING SPACES AND ACCESS AISLES SHALL BE LEVEL WITH SURFACE SLOPES NOT EXCEEDING 1:50 IN ALL DIRECTIONS.
- D. ACCESSIBLE CURB RAMP AT INTERSECTIONS SHALL BE ALIGNED WITH STREET CROSSWALKS.
- E. THE MAXIMUM LONGITUDINAL SLOPE ALLOWED ON ANY CURB RAMP OR SIDEWALK SHALL BE 1"/FT. (8.33%). THE MAXIMUM CROSS SLOPE ALLOWED ON ANY WALKING ROUTE IS 1:50 (2%) (1/4"/FT.)
- F. THE SURFACE OF ALL ACCESSIBLE RAMPS AND FLARED SIDES SHALL BE FINISHED WITH A COURSE BROOMED TEXTURE PERPENDICULAR TO THE SLOPE OF THE RAMP.
- G. ALL HANDICAP RAMPS, PARKING STALLS AND LANDINGS, SHALL CONFORM TO THE UNIFORM FEDERAL ACCESSIBILITY STANDARDS (UFAS) LATEST EDITION.

STANDARD ACCESSIBLE PARKING STALL

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SEE CITY OF MONTROSE MUNICIPAL CODE SECTION 4-2-7(C)
FOR PARKING SPACE DIMENSIONS.

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PARKING STALL WITH BUMPER BLOCK

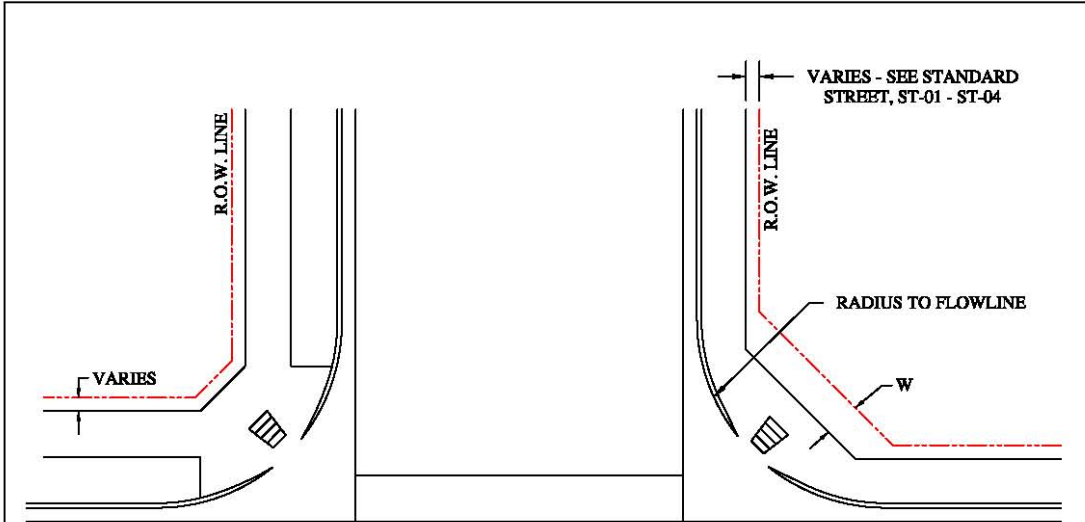


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INTERSECTING STREETS	RADIUS TO FLOWLINE OF GUTTER	MIN. WIDTH (W) FROM BACK OF SIDEWALK TO RIGHT-OF-WAY LINE
MAJOR ARTERIAL	35'	5'
MINOR ARTERIAL	30'	5'
COLLECTOR	30'	5'
URBAN STREET	25'	2'
RESIDENTIAL STREET	20'	2'

NOTE: USE COLLECTOR STREET DIMENSIONS FOR COMMERCIAL STREETS.

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RADI AND RIGHT-OF-WAY WIDTH AT INTERSECTION CORNER

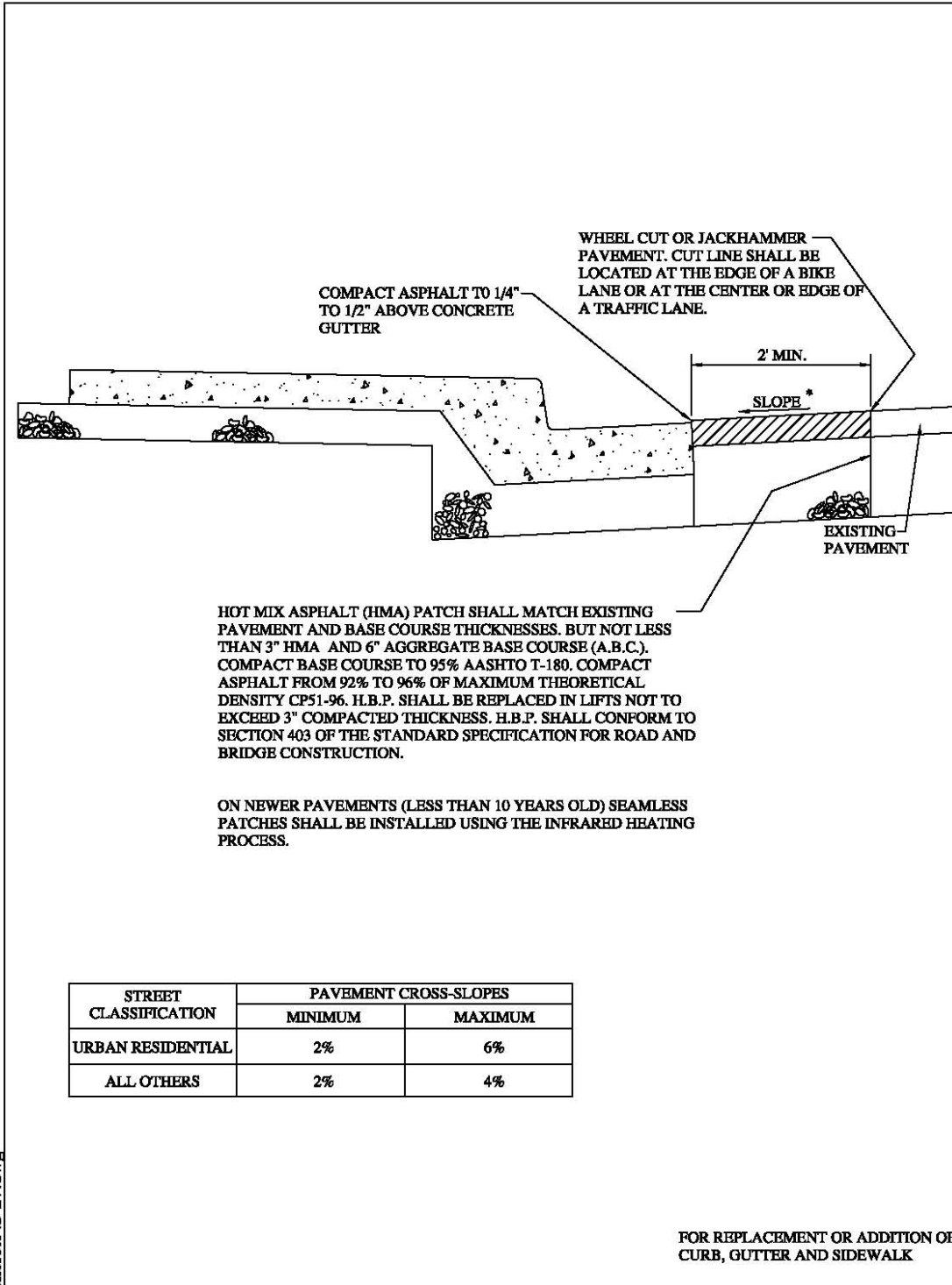


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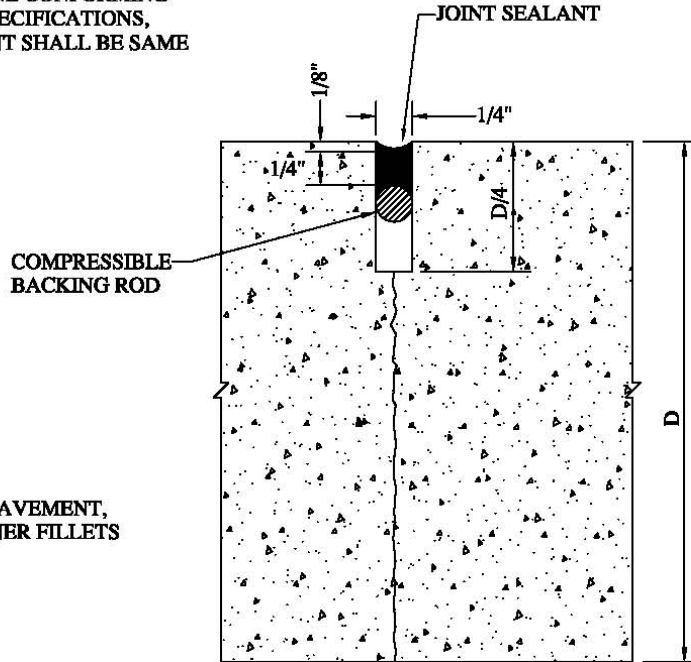
STREET CLASSIFICATION	PAVEMENT CROSS-SLOPES	
	MINIMUM	MAXIMUM
URBAN RESIDENTIAL	2%	6%
ALL OTHERS	2%	4%

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ASPHALT PATCHING

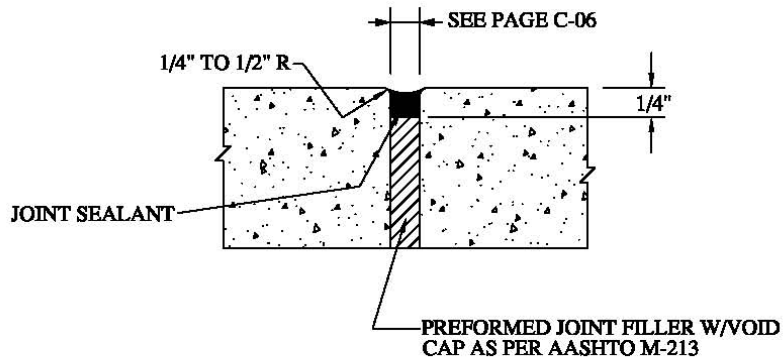
<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD CONCRETE DETAILS</p>	APPROVED: <u>LAR</u>	<p>PAGE C-27</p>
			REV: <u>JULY 2003</u>	
			DRAWN BY: <u>ELR</u>	

JOINT SEALANT SHALL BE POLYURETHANE CONFORMING TO ASTM C-920-87, NPI OR SILICONE CONFORMING TO CDOT STANDARD SPECIFICATIONS, SECTION 705.01. SEALANT SHALL BE SAME COLOR AS CONCRETE.



ALL JOINTS IN CONCRETE PAVEMENT, DRAINAGE PANS AND CORNER FILLETS SHALL BE SEALED.


CONTRACTION JOINT



EXPANSION JOINT

JOINT SEAL

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DOWELED ISOLATION OR EXPANSION JOINT

UNDOWELED ISOLATION JOINT

UNDOWELED CONTRACTION JOINT

THICKENED EDGE ISOLATION JOINT

EMERGENCY CONSTRUCTION JOINT
(LOCATED IN MIDDLE 2/3 OF NORMAL JOINT INTERVAL)

DOWELED CONTRACTION JOINT OR PLANNED CONSTRUCTION JOINT

DOWEL SIZE FOR JOINTED REINFORCED PAVEMENTS AND CONSTRUCTION JOINTS		
SLAB DEPTH INCHES	DOWEL DIAMETER INCHES	TOTAL DOWEL LENGTH INCHES
6.0	3/4	14
6.5	7/8	14
7.0	1	16
7.5	1-1/8	16
8.0	1-1/4	17

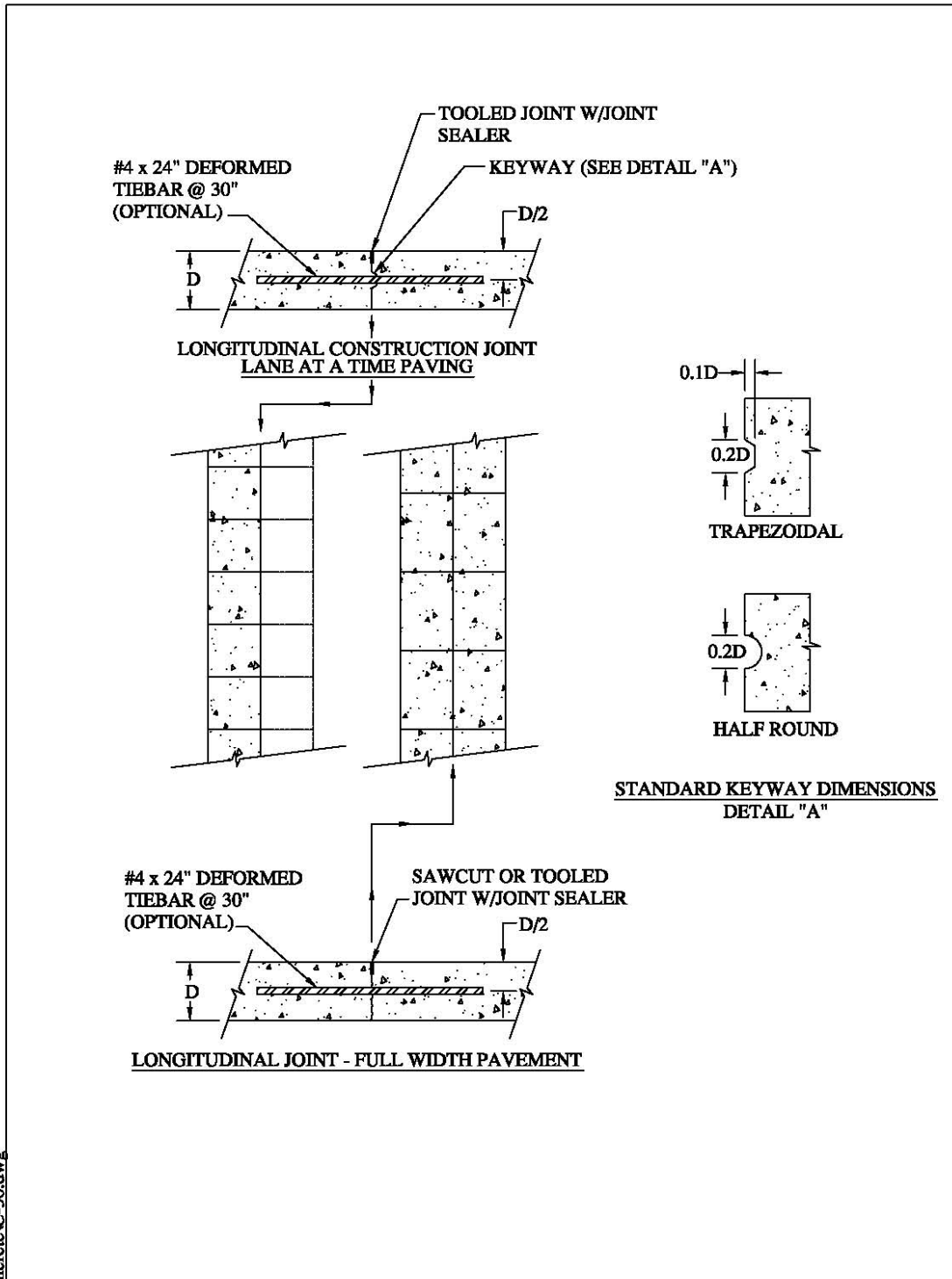
NOTES

- ALL JOINTS IN CONCRETE PAVEMENT SHALL BE SEALED PER DETAILS ON PAGE C-28.
- SEE PAGE C-30 FOR LONGITUDINAL JOINT DETAILS.
- ALL HANDTOOLED JOINTS SHALL BE FINISHED WITH A 1/4" OR SMALLER RADIUS.

JOINT DETAILS FOR CONCRETE PAVEMENT

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			<p>REV: <u>JULY 2003</u></p> <p>DRAWN BY: <u>ELL</u></p>	

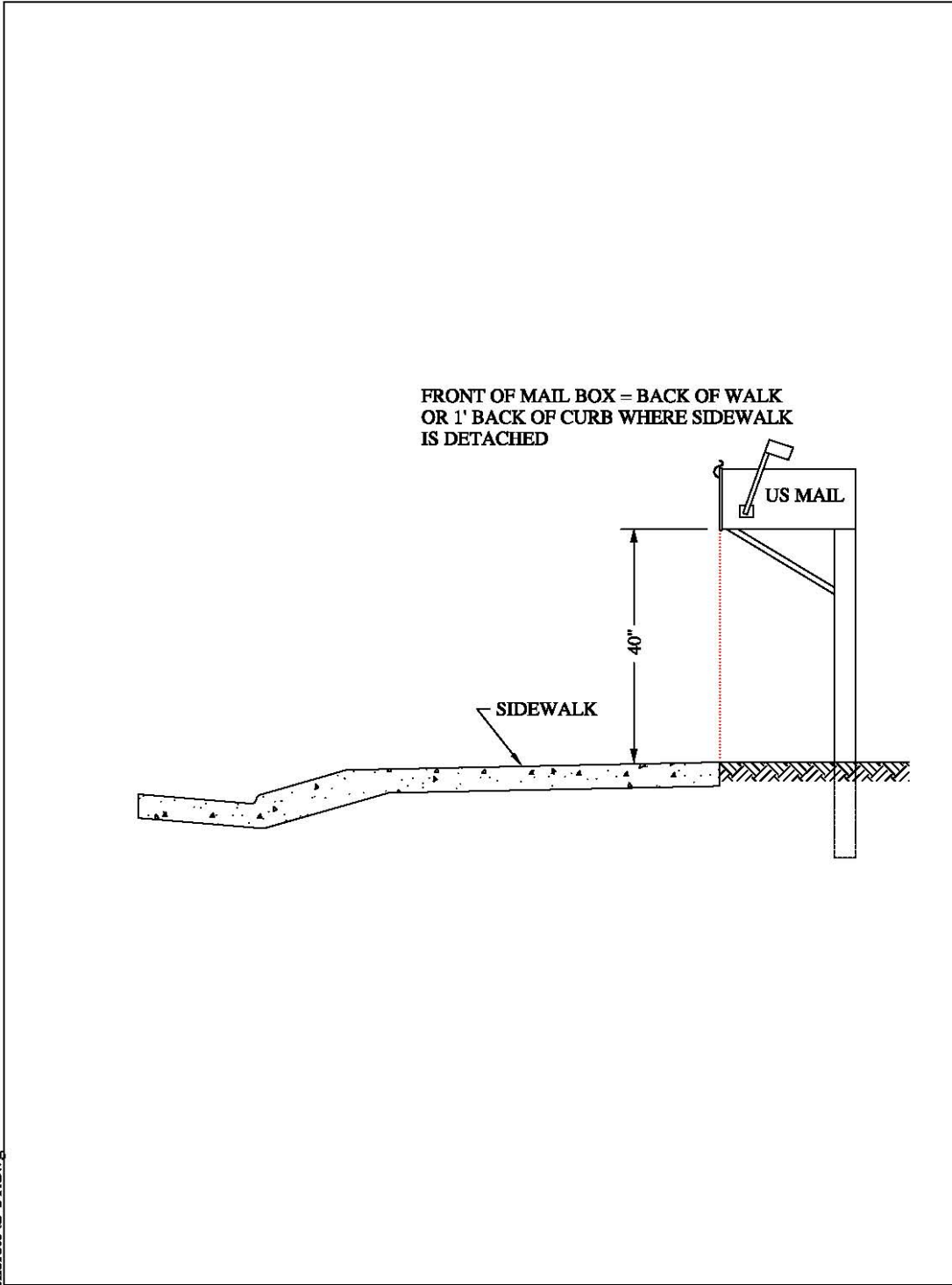
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LONGITUDINAL JOINTS FOR CONCRETE PAVEMENT

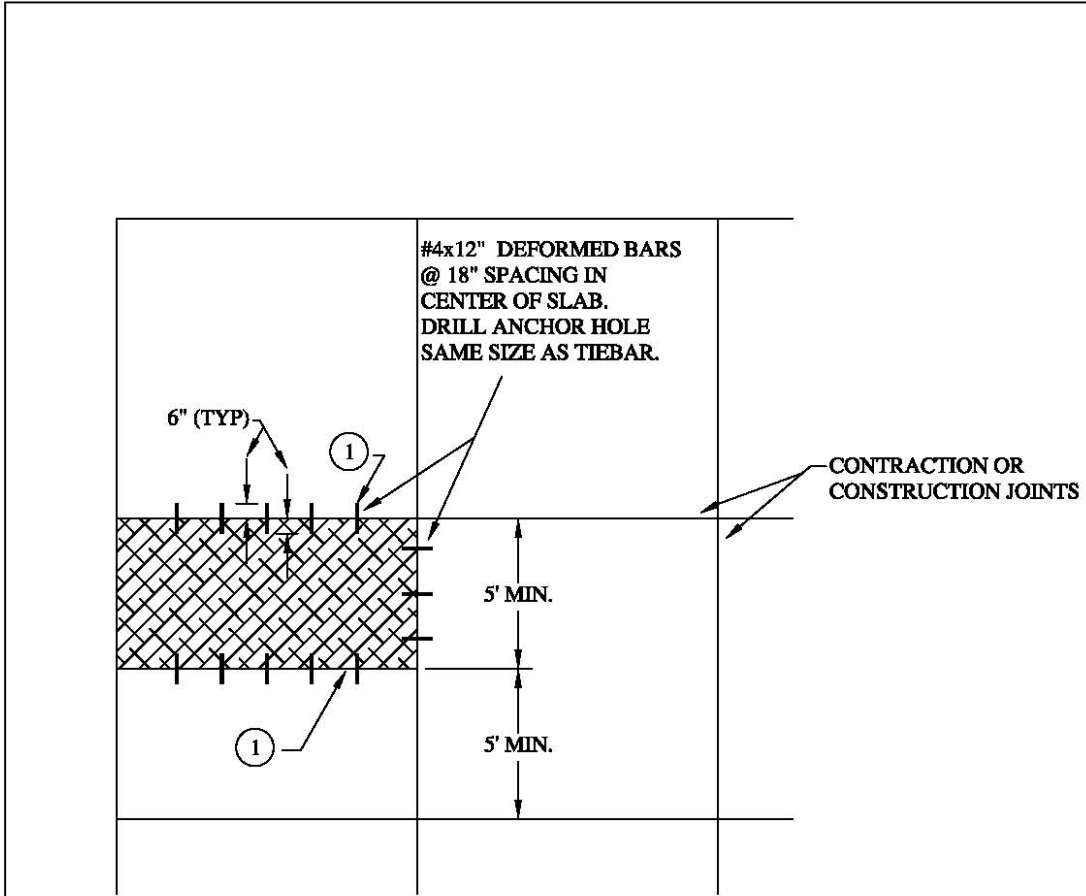
 <p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD CONCRETE DETAILS</p>	<p>APPROVED: <u>LAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>ELR</u></p>	<p>PAGE C-30</p>
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MAIL BOX INSTALLATION

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1. CONCRETE SHALL BE REMOVED TO A SAWCUT LINE OR TO AN EXISTING JOINT.
2. ALL JOINTS SHALL BE CUT THROUGH 90 PERCENT OF CONCRETE THICKNESS PRIOR TO CONCRETE REMOVAL.
3. CONCRETE EDGES OR SURFACES THAT ARE BROKEN, CHIPPED, CRACKED OR OTHERWISE DAMAGED DURING PAVEMENT REMOVAL SHALL BE CUT AND REMOVED AS DIRECTED BY THE CONSTRUCTION INSPECTOR.
4. ALL PATCHES SHALL BE MADE WITH CDOT CLASS B CONCRETE. SAME THICKNESS AS ADJACENT PAVEMENT.

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PATCH IN CONCRETE PAVEMENT

 CITY OF MONTROSE	PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT	STANDARD CONCRETE DETAILS	APPROVED: <u>SLR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>SLR</u>	PAGE C-32
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CHAPTER 9-6

DRAINAGE & EROSION CONTROL STANDARDS

Sections:

- 9-6-1 GENERAL PROVISIONS
- 9-6-2 DESIGN CRITERIA FOR DRAINAGE FACILITIES
- 9-6-3 DETENTION PONDS
- 9-6-4 CONSTRUCTION MATERIALS
- 9-6-5 EROSION CONTROL PLANS
- 9-6-6 FINAL INSPECTION AND ACCEPTANCE
- 9-6-7 STORM WATER SYSTEM DETAILS

9-6-1: GENERAL PROVISIONS

- (A) **General.** The Drainage and Erosion Control Standards are intended to provide for a comprehensive and integrated storm water utility system to convey and manage storm waters in order to mitigate safety hazards and minimize property losses and disruption due to heavy storm runoff and flooding, maintain travel on public streets during storm events, enhance water quality of storm runoff by mitigating erosion, sediment and pollutant transport, control and manage increased runoff due to local development, establish effective long-term management of natural drainageways, and provide for ongoing and emergency maintenance of public storm water systems.
- (B) **Streets.** Streets are an integral part of the local storm water drainage system and may transport local storm runoff as specified in these Standards. However, the primary purpose of streets is for transportation, and storm water conveyance shall not be the major function of a street.

9-6-2: DESIGN CRITERIA FOR DRAINAGE FACILITIES

(A) **General.** This section presents the minimum design criteria for the analysis and design of storm drainage facilities. All subdivision, zoning, and other proposed site development submitted for approval under the provisions of the City Municipal Code shall include adequate storm drainage system analysis and appropriate drainage system design. These are minimum standards. All analysis and design shall meet or exceed these Drainage Standards.

(B) **Drainage Report.** The drainage report shall contain the information and calculations supporting the design of the storm drainage system detailed in the engineering drawings. Such information and calculations shall be presented in a neat and orderly fashion to facilitate review.

The report shall include an analysis of the area under consideration in reference to the zoning, historical and developed conditions, existing topography, contributing runoff from upstream areas, control easements or features, and continuity with a master plan or with the existing drainage. Natural drainage ways are to be used whenever possible. However, when any irrigation ditch is to be used as part of the storm drainage system, the drainage report shall include a thorough hydraulic engineering analysis demonstrating that such use is without unreasonable hazard.

The report shall contain the hydrologic analysis including areas, storm frequencies, rainfall intensities, runoff coefficients, times of concentration, adjustments for infrequent storms, and all runoff computations.

Engineering analyses of all culverts, open channels, and box culverts shall include the design criteria, computations, and figures for any detention facility design. The drainage report shall include a soils analysis and water table elevations. All calculations, mass diagrams, and/or hydrographs (methods used will depend on the area of the basin to be analyzed) required to size the detention facility and determine its discharge shall also be included.

All drainage reports shall include a cover letter indicating the date, the name of the project or subdivision, the Engineer or Engineers designing the system, and shall be stamped and signed by an Engineer.

(C) **Pipe Sizing.** Minimum circular pipe inside diameter shall be as follows:

Main storm sewer line	15"
Catch basin lateral	12"
Driveway or other culvert	12"
Equivalent sized arch pipe may be used upon written request.	

- (D) **Manholes.** Maximum allowable manhole spacing shall be as follows:

<u>Horizontal pipe dimension (inches)</u>	<u>Maximum allowable distance Between Manholes</u>
15 to 30	400'
36 to 60	500'
Larger than 60	750'

Manholes shall be placed wherever there is a change in size, direction, elevation or slope where there is a junction of two or more systems or laterals, or where the maximum distance above is reached.

Interior diameter of all storm sewer manholes shall be as follows:

<u>Horizontal pipe dimension (inches)</u>	<u>Minimum barrel diameter (feet)</u>
15 to 18	4
21 to 48	5
Larger than 48	6

The City may require a larger barrel sizing should conditions warrant.

- (E) **Clearance Distances.** The minimum clearance between storm sewer and water main, either above or below, shall be twelve inches. In all cases, suitable backfill and/or other protection as deemed necessary by the City Engineer shall be provided to prohibit settling or failure of either pipe system.

The minimum clearance between storm sewer and sanitary sewer, either above or below, shall also be twelve inches. However, when a sanitary sewer main lies above a storm sewer, or within eighteen inches below, the sanitary sewer shall have an impervious encasement or be constructed of structural sewer pipe for a minimum of ten feet on each side of where the storm sewer crosses.

- (F) **Head Wall Requirement.** A concrete head wall at least eight inches thick shall be required at all transitions between culverts and ditches. Alternate means of protecting culvert ends from vehicle damage and channeling runoff into culverts will be reviewed on a case by case basis by the City Engineer.

9-6-3: DETENTION PONDS

- (A) **General.** Detention ponding facilities are intended to store increased runoff from developed property and release this runoff at the historic rate that existed prior to development or redevelopment. By providing detention ponding, increased runoff impacts on downstream facilities may be controlled and minimized to reduce potential damages and the need for greatly expanded storm water conveyance facilities.

- (B) **Required.** Detention ponding for storm water shall be provided for all new development or redevelopment, other than single-family lots that are not part of a larger development and subdivisions of one single-family lot into two single-family lots where the runoff coefficient for the site is increased, unless runoff for the initial and major storm events from the entire tributary basin can be conveyed directly to the major drainage system without adverse impact on upstream, surrounding, or downstream properties and facilities and storm water detention to meet water quality mitigation measures is not required.
- (C) **Design Storms.** Detention ponds shall be designed 25-year, 24-hour storm event, as a combined facility, and shall satisfy the separate storage and release conditions for each storm event. The design release rates shall be restricted such that runoff from the entire parcel and tributary basin to be developed or redeveloped does not exceed the historic runoff for the storm event that occurred prior to the proposed development or redevelopment. Where existing downstream facilities have been designed for a storm with a lesser frequency than required by this document, additional storage may be required to maintain historic release rates during that lower frequency storm event.
- (D) **Maintenance.** The property owner shall be responsible for maintaining stormwater detention facilities.

9-6-4: CONSTRUCTION MATERIALS

- (A) **General.** Construction of storm water-related public improvements shall be in compliance with these Standards. All pipe and structures shall be of adequate strength to support trench and AASHTO HS-20 highway loadings.
- (B) **Piping.** The type of pipe and structures to be installed shall comply with these Standards, and shall be based upon applicable design flows, site conditions, and maintenance requirements. Acceptable type of pipe conforming to these standards are the following:
- Reinforced Concrete Pipe (RCP)
 - Polyvinyl Chloride (PVC)
 - Corrugated High Density Polyethylene or ADS

9-6-5: EROSION CONTROL PLANS

(A) **General.** All construction activity within the City must address stormwater pollution prevention. For construction sites with land disturbance areas 1 acre or larger, the applicant must obtain a CDPS General Permit (NPDES Program) for Stormwater Discharges Associated with Construction Activity. The application for the above General Permit must be submitted at least 10 days prior to the start of the project. A Stormwater Management Plan (SWMP) must be prepared prior to submittal and Best Management Practices in place before construction begins. Please refer to the Colorado Department of Public Health and Environment (CDPHE) website, <http://www.cdphe.state.co.us/wq/PermitsUnit>, for an index to permit documents available on the internet. The remainder of this section addresses all other construction activity not regulated by the CDPHE. All other construction activities must submit an Erosion Control Plan with their site application. An erosion control plan consisting of a written narrative and a site plan map must be submitted to the City Engineer for review and approval. The narrative report must contain a project description, existing site conditions, and the name of the professional preparing the report.

(B) **Performance Objectives.** The primary performance objectives of an erosion control plan include:

- (1) Conduct all land disturbance activities in a manner that effectively reduces accelerated soil erosion and reduces sediment transport and offsite deposition.
- (2) Design and construct all temporary or permanent facilities for the conveyance of water around, through, or from the disturbed area to limit the flow of water to non-erosive velocities.
- (3) Remove sediment caused by accelerated soil erosion from surface runoff water before it leaves the site.
- (4) Stabilize the areas of land disturbance with permanent vegetative cover or stormwater quality control measures.

Timing of implementing measures is one of the most critical factors involved in the control of erosion from developing and redeveloping sites.

(C) **Erosion Control Measures:** There are two types of water erosion control measures; those that prevent initial movement (cover factor, non-structural measures) and those that reduce sediment from moving water (practice factor, structural measures). Erosion control measures must be properly designed, installed and maintained if they are to accomplish their intended purpose and effectiveness.

- (1) **Non-structural Erosion Control Measures.** Non-structural erosion control measures provide the best means of managing sediment from disturbed lands by preventing soil movement. Dissipating the kinetic energy of rainfall by placing cover (e.g., straw, burlap, mulch, etc.) over disturbed areas to prevent initial sediment transport.

One of the more effective practices is the use of vegetation. Vegetative measures can provide temporary cover to help control erosion during construction and permanent cover to stabilize a site after construction is completed. The measures include the use of sod, planting of temporary cover crops and establishing permanent cover crops.

When establishing a permanent dry land grass cover, two or more different types of seeds must be used and usually with a hydromulch. It is important to establish vegetative cover as soon as possible in order to reduce erosion. An approved seed mix design shall be used to reestablish vegetative cover in the City right-of-way. Hydromulching is essential in establishing good stands of grass on moderate to steep slopes, and on other areas where it is difficult to establish vegetation.

- (2) **Structural Erosion Control Measures.** Once erosion commences due to water, structural measures have to be utilized to reduce sediment transport from disturbed lands. Below are some of the more practical and cost effective measures used in implementing an erosion control plan. These are some of the common structural Best Management Practices for controlling erosion.

- Sediment trap basins
- Diversions
- Terraces
- Berms
- Surface roughing
- Filter berms
- Sediment barriers
- Straw bales
- Filtered inlets
- Contour wind row

Please refer to the Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria* manual, *Volume 3, Construction BMPs* document for generally accepted guidance on BMP implementation for construction activity. You may access the above document for free at <http://www.udfcd.org>.

9-6-6: FINAL INSPECTION AND ACCEPTANCE

- (A) **General.** The acceptance of all public improvements by the City, based on red-lined as-builts of improvement facilities is required PRIOR to paving or concrete work, and passing a final inspection of the Work by the City Engineer or his representative.
- (B) **Contractor's Warranty.** The Contractor shall guarantee his work to be free from defects in materials and workmanship for a period of not less than one year, the initial Acceptance Period. At the end of the 1-year initial Acceptance period and at the request of the Contractor the City Engineer and the Contractor shall jointly observe the work. The City Engineer may request such tests and inspections as deemed necessary, and consistent with these specifications. Any defects in the system resulting from defective materials, poor workmanship or any other cause attributable to the contractors work shall be corrected by the contractor, to the satisfaction of the City Engineer at the Contractor's expense.
- (C) **As-Built Drawings.** Two sets of As-Built construction drawings shall be submitted on 24" x 36" or 22" x 34" paper or vellum in accordance with the Montrose submittal standards in Chapter 9-1. An Engineer shall stamp and sign all As-Built drawings prior to submittal. As-Built drawings shall also be submitted as an electronic AutoCAD file in accordance with the Montrose submittal standards in Chapter 9-1.


9-6-7: STORM WATER SYSTEM DETAILS

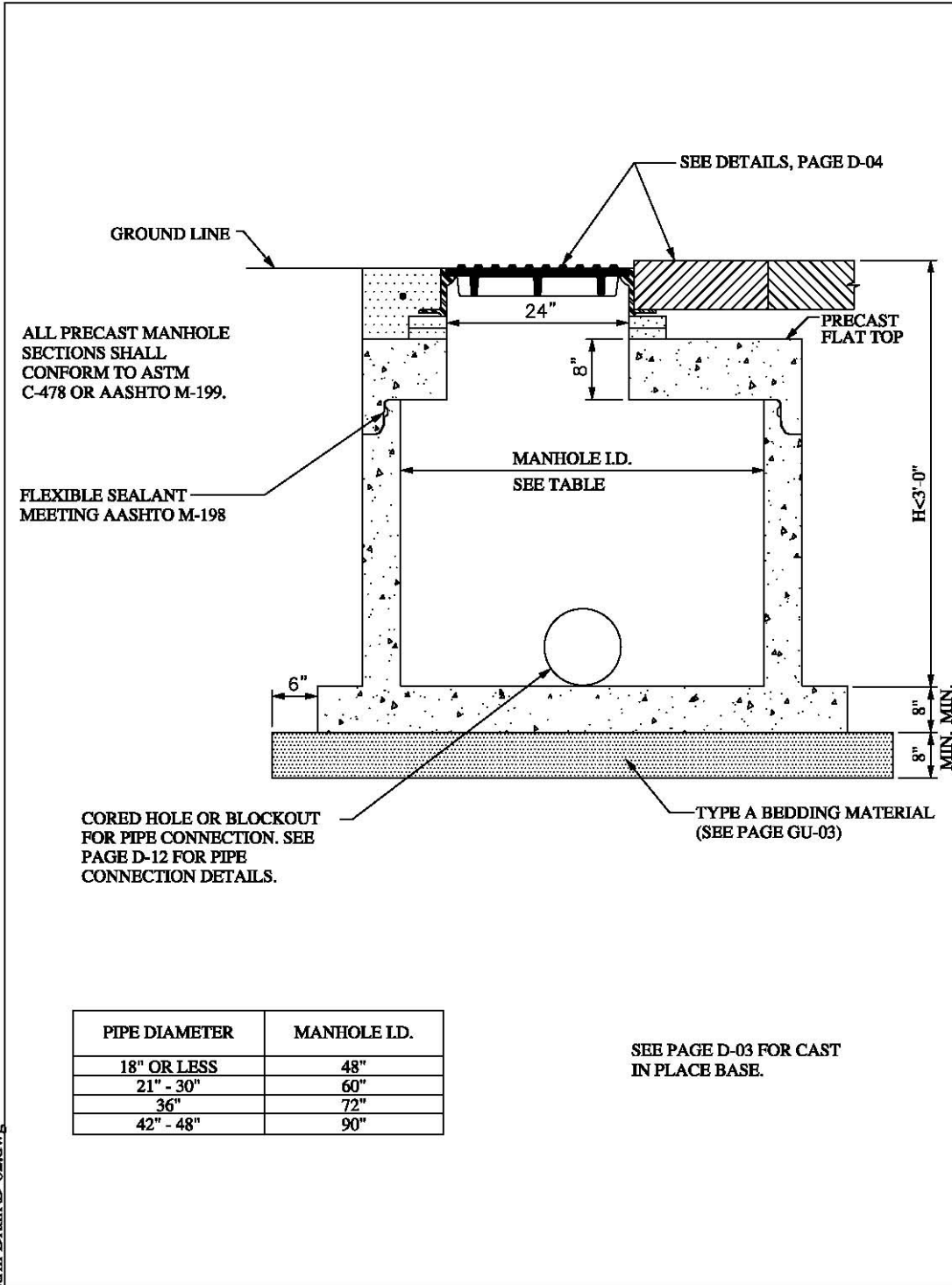
- D-01 General Notes
- D-02 Standard Shallow Manhole – Precast Base
- D-03 Standard Manhole – Cast in Place Base
- D-04 Standard Cast Iron Manhole Ring and Cover
- D-05 Approved Storm Drain Inlets
- D-06 Single Storm Drain Inlet with Driver Over Curb Opening
- D-07 Single Storm Drain Inlet with Vertical Curb Opening
- D-08 Double Storm Drain Inlet with Vertical Curb Opening
- D-09 Triple Storm Drain Inlet with Vertical Curb Opening
- D-10 Large Area Inlet
- D-11 Small Area Inlet
- D-12 Connection to Existing Pipe, Manhole or Inlet Box
- D-13 Drain Through for Sidewalk Crossing
- D-14 Frame and Cover for Sidewalk Drain Through

1. BACKFILL AROUND MANHOLES, INLET BOXES, AND OTHER STRUCTURES SHALL BE PLACED IN 8" LIFTS AND COMPACTED TO 90% AASHTO T-180.
2. ALL PORTLAND CEMENT CONCRETE SHALL BE COLORADO DEPARTMENT OF TRANSPORTATION CLASS "B". (SECTION 601.02).
3. ANY EXISTING PAVEMENT NOT DESIGNATED FOR REMOVAL WHICH IS DAMAGED BY CONSTRUCTION SHALL BE REPLACED IN-KIND BY CONTRACTOR.
4. ALL CONCRETE WORK WITHIN PUBLIC RIGHT-OF-WAY SHALL BE PERFORMED BY A LICENSED CITY CONTRACTOR.
5. SEE APPROVED CONSTRUCTION DRAWINGS FOR ALL LOCATIONS, GRADES AND ELEVATIONS OF ALL DRAINAGE IMPROVEMENTS.
6. MANHOLE RING AND COVER AND INLET GRATE AND FRAME SHALL BE ADJUSTED TO FINISHED GRADE USING NON-SHRINK GROUT. GROUT THICKNESS SHALL NOT EXCEED 2 INCHES. GROUT SHALL BE PLACED UNDER THE CAST IRON RING OR FRAME. NO GROUT SHALL BE PLACED BETWEEN THE CONCRETE GRADE RINGS. STEEL PAVING RINGS MAY BE USED FOR ADJUSTMENT OF MANHOLE COVERS TO GRADE ONLY WHEN A STREET IS OVERLAID. PAVING RINGS ARE NOT ALLOWED IN NEW CONSTRUCTION.
7. SEE THE CITY OF MONTROSE STORMWATER MANAGEMENT MANUAL FOR STORMWATER DESIGN CRITERIA.
8. ALL WORK SHALL BE IN ACCORDANCE WITH APPROVED PLANS, STANDARD STORM DRAIN DETAILS AND THE STANDARD SPECIFICATIONS FOR CONSTRUCTION OF UNDERGROUND UTILITIES.
9. STORM DRAIN INLET BOXES MAY BE MADE FROM STACKABLE PRECAST BOX SECTIONS WITH TONGUE AND GROOVE JOINTS AND FLEXIBLE SEALANT BETWEEN SECTIONS. THE TOP SECTION OF THE INLET BOX SHALL HAVE A GROOVE-LESS FLAT SURFACE TO SUPPORT THE INLET FRAME AND GRATE.

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GENERAL NOTES

 <p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD STORM DRAIN DETAILS</p>	<p>APPROVED: <u>ELR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>ELR</u></p>	<p>PAGE D-01</p>
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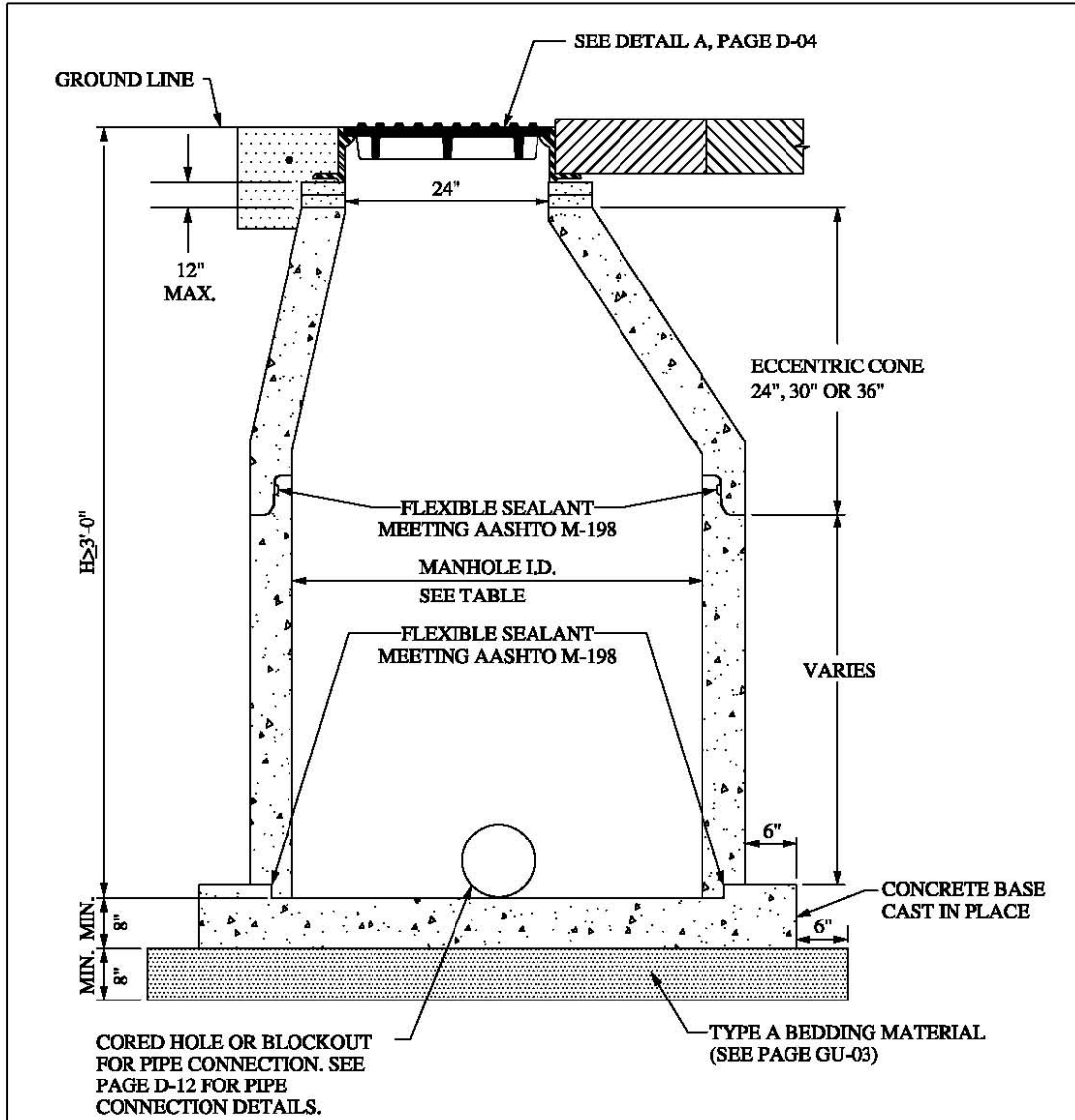
PIPE DIAMETER	MANHOLE I.D.
18" OR LESS	48"
21" - 30"	60"
36"	72"
42" - 48"	90"

SEE PAGE D-03 FOR CAST IN PLACE BASE.

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STANDARD SHALLOW MANHOLE - PRECAST BASE

<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION</p> <p>QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD STORM DRAIN DETAILS</p>	APPROVED: <u>LAR</u>	<p>PAGE D-02</p>
			<p>REV: <u>JULY 2003</u></p> <p>DRAWN BY: <u>ELR</u></p>	



CORED HOLE OR BLOCKOUT FOR PIPE CONNECTION. SEE PAGE D-12 FOR PIPE CONNECTION DETAILS.

TYPE A BEDDING MATERIAL (SEE PAGE GU-03)

PIPE DIAMETER	MANHOLE I.D.
18" OR LESS	48"
21" - 30"	60"
36"	72"
42" - 48"	90"

ALL PRECAST MANHOLE SECTIONS SHALL CONFORM TO ASTM C-478 OR AASHTO M-199.

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STANDARD MANHOLE - CAST IN PLACE BASE

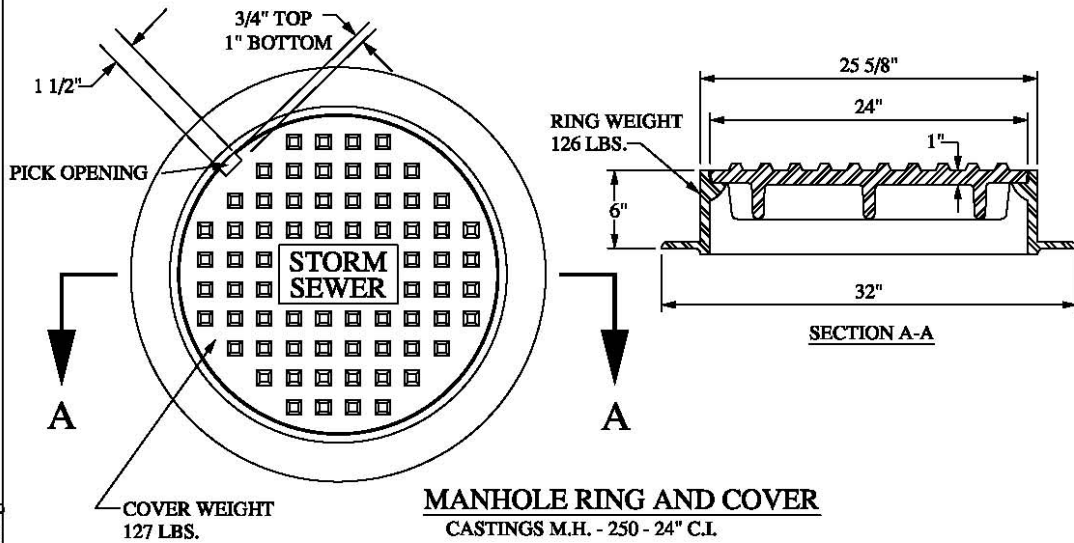
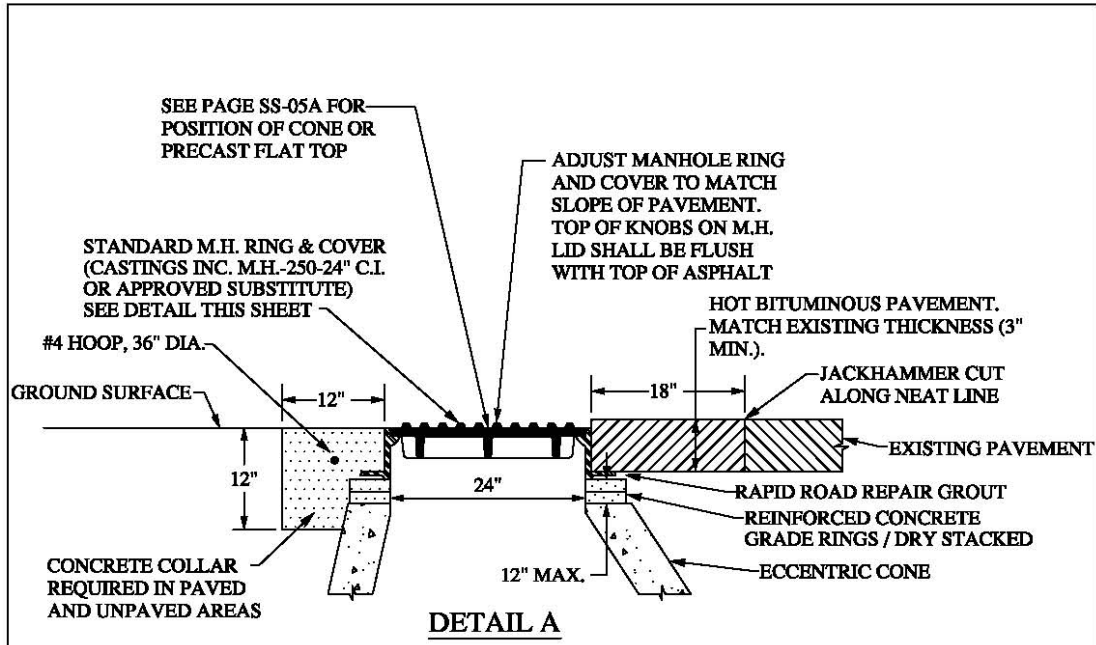


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STANDARD STORM
DRAIN DETAILS

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STANDARD CAST IRON MANHOLE RING AND COVER



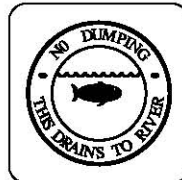
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DRAIN DETAILS

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REV: JULY 2003
DRAWN BY: SLR

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APPROVED STORM DRAIN INLETS			
TYPE	FRAME	GRATE TYPE	BOX DIM. INSIDE
SINGLE GRATE WITH CURB OPENING	NEENAH R-3246	C,DR,DL,L,V	24 X 36"
	CASTINGS IFG-3246-CI	C,DR,DL,L,V	
	DEETER 2045	C,DR,DL,L,V	
DOUBLE GRATE WITH CURB OPENING	NEENAH R-3296-A	C,DR,DL,L,V	24" X 73"
	CASTINGS IFG-3246,DOUBLE	C,DR,DL,L,V	
	DEETER R-2045,DOUBLE	C,DR,DL,L,V	
TRIPLE GRATE WITH CURB OPENING	NEENAH R-3296-B	C,DR,DL,L,V	24" X 110"
	CASTINGS IFG-3246,TRIPLE	C,DR,DL,L,V	
	DEETER 2045,TRIPLE	C,DR,DL,L,V	
AREA INLET	CASTINGS FG-1927-CI	C	20" X 30"
	OR CASTINGS NO. 13	C	20" x 36"
C.D.O.T. TYPE R	SEE STANDARD M-604-12		
C.D.O.T. TYPE 13	SEE STANDARD M-604-13		



PLACARD TO BE PLACED ON EACH
STORM SEWER OPENING INSTALLED
WITHIN THE SYSTEM SERVED BY THE
CITY OF MONTROSE

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APPROVED STORM DRAIN INLETS

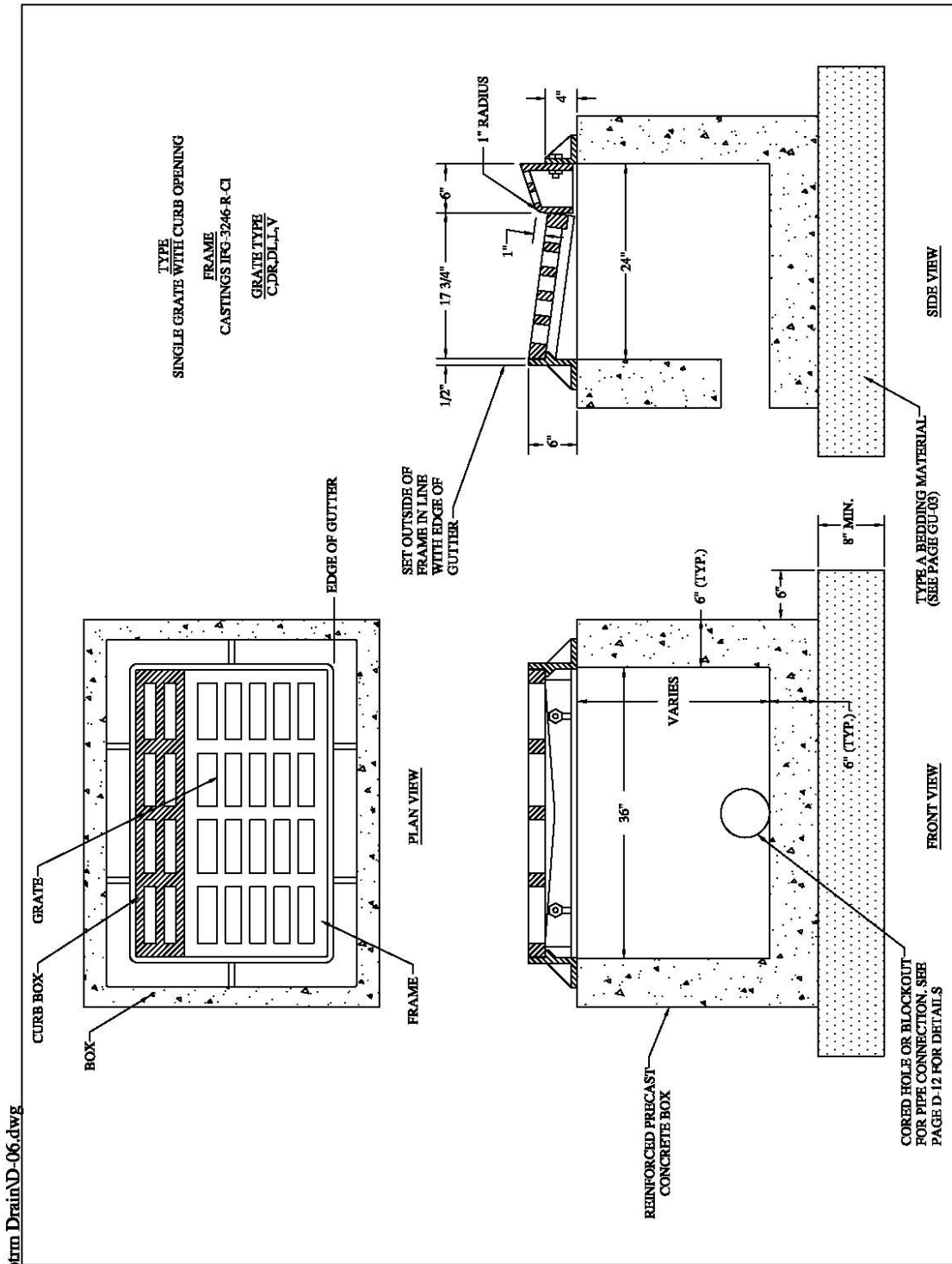


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DRAIN DETAILS

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SINGLE STORM DRAIN INLET WITH DRIVE OVER CURB OPENING

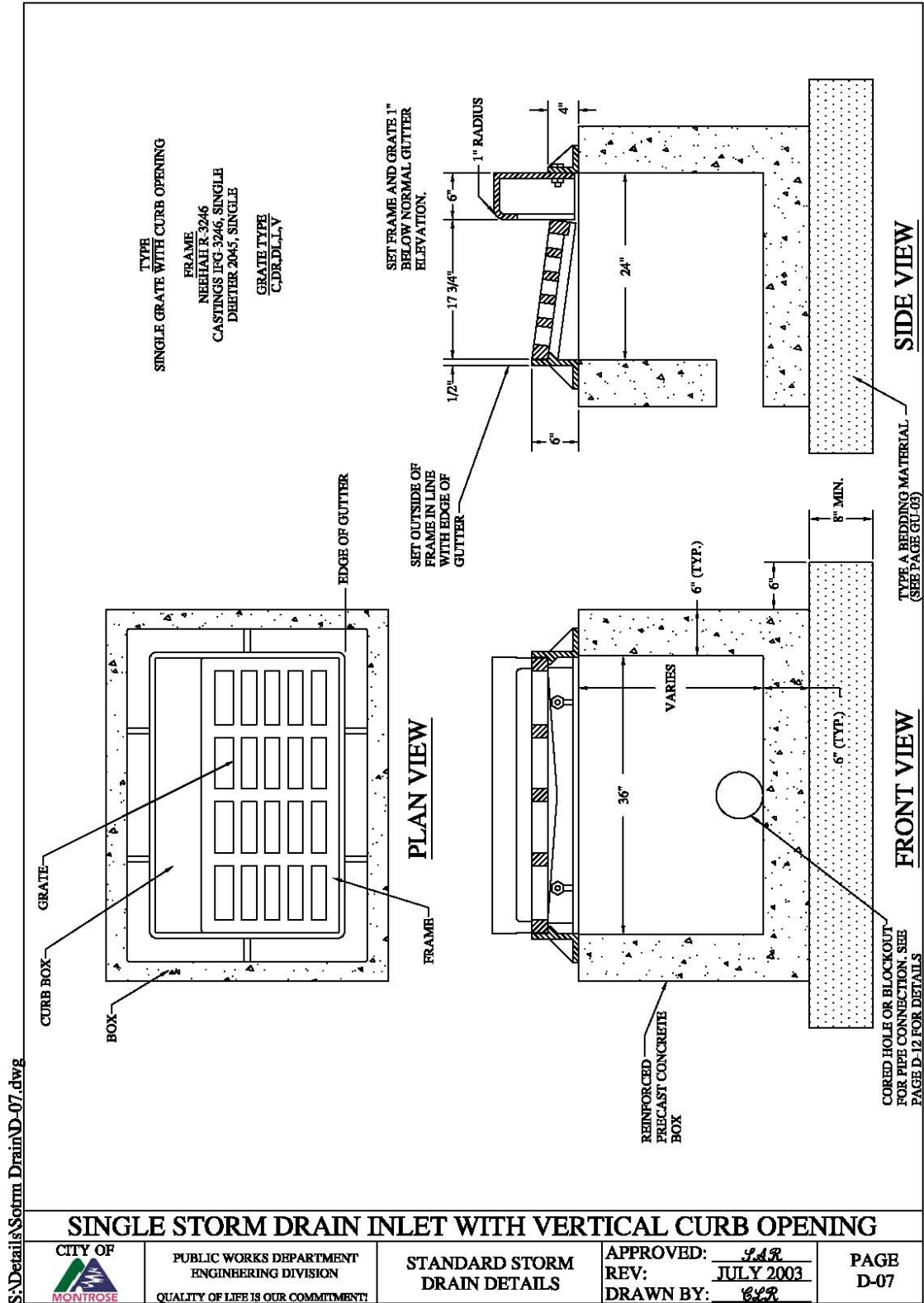


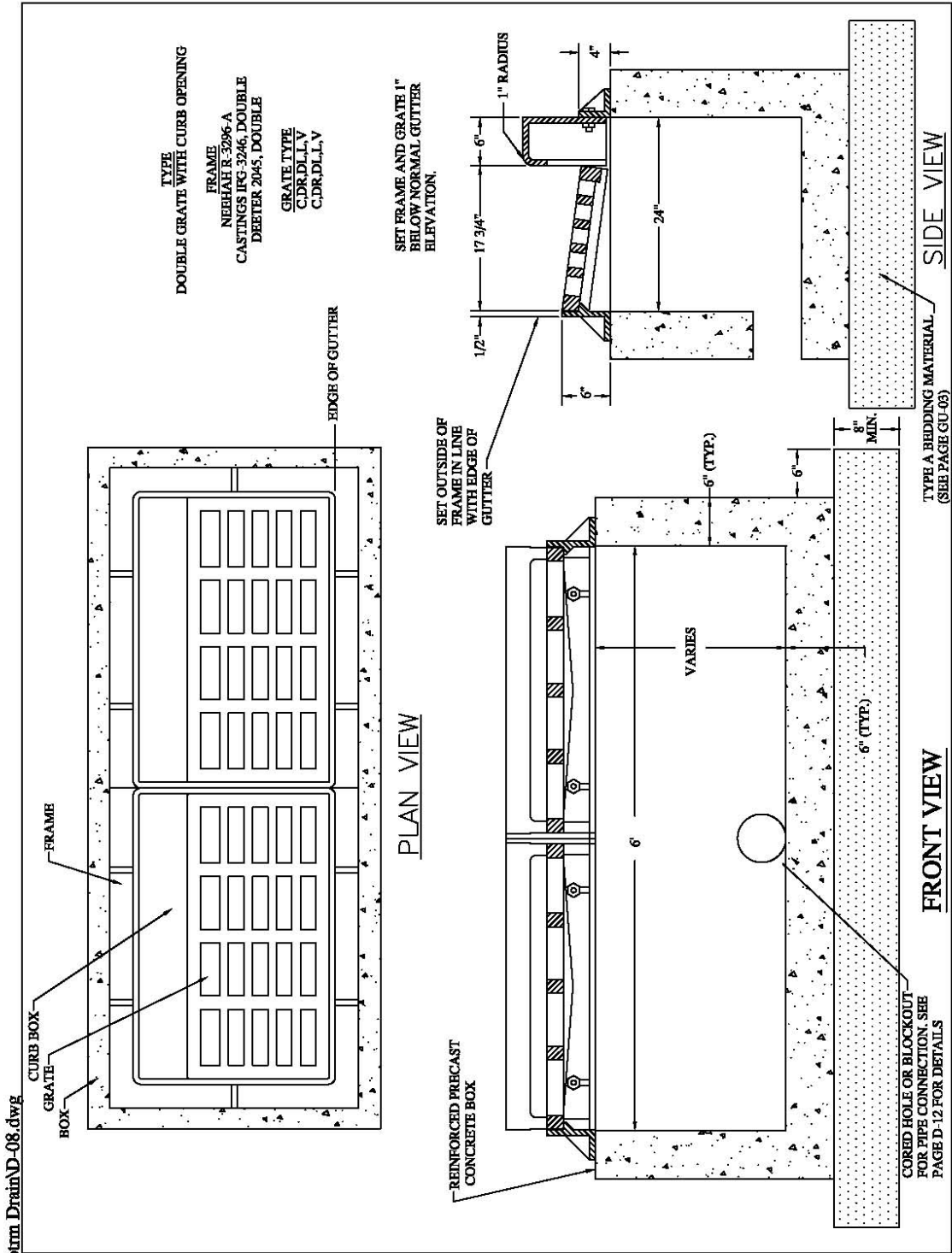
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DRAIN DETAILS

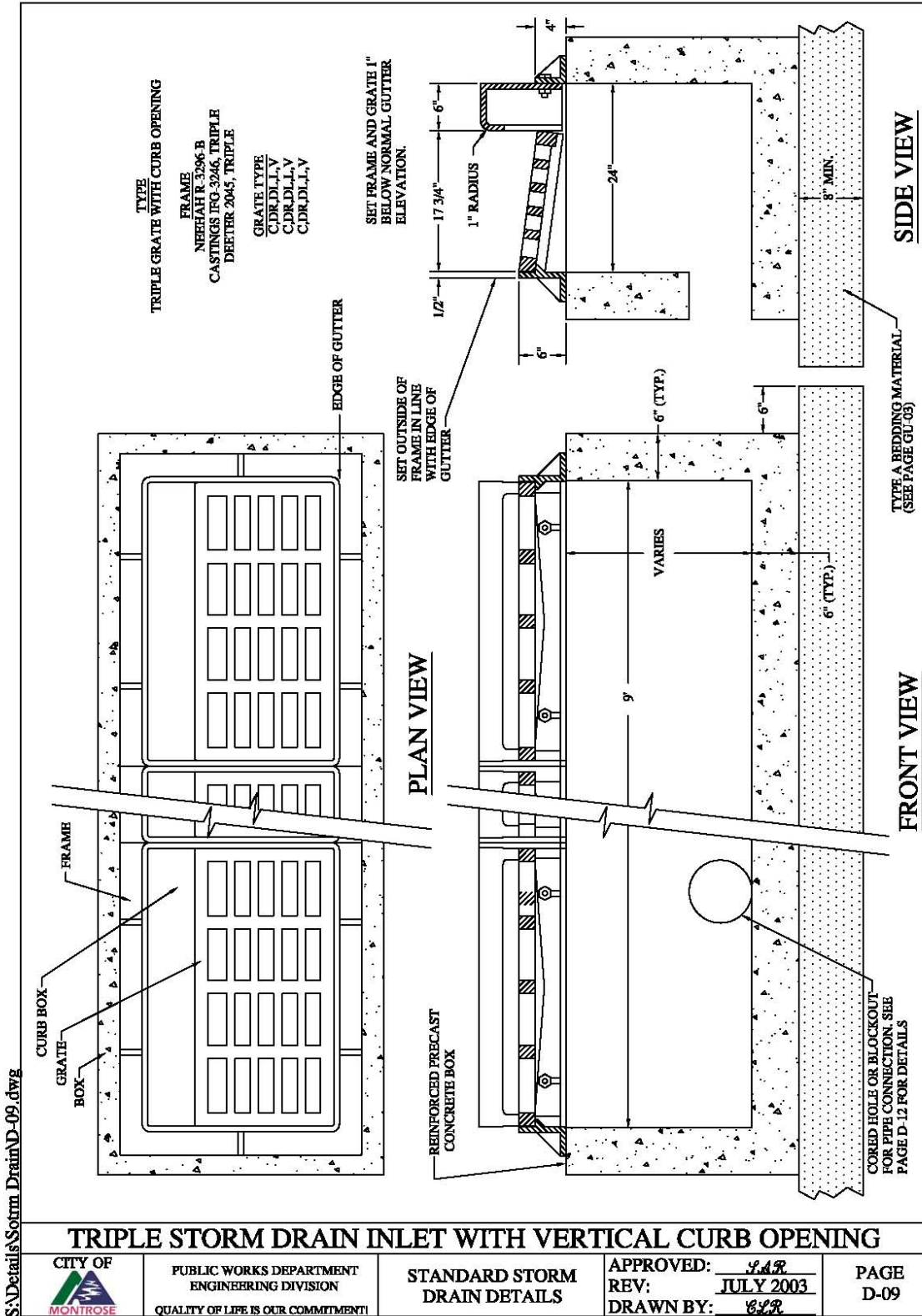
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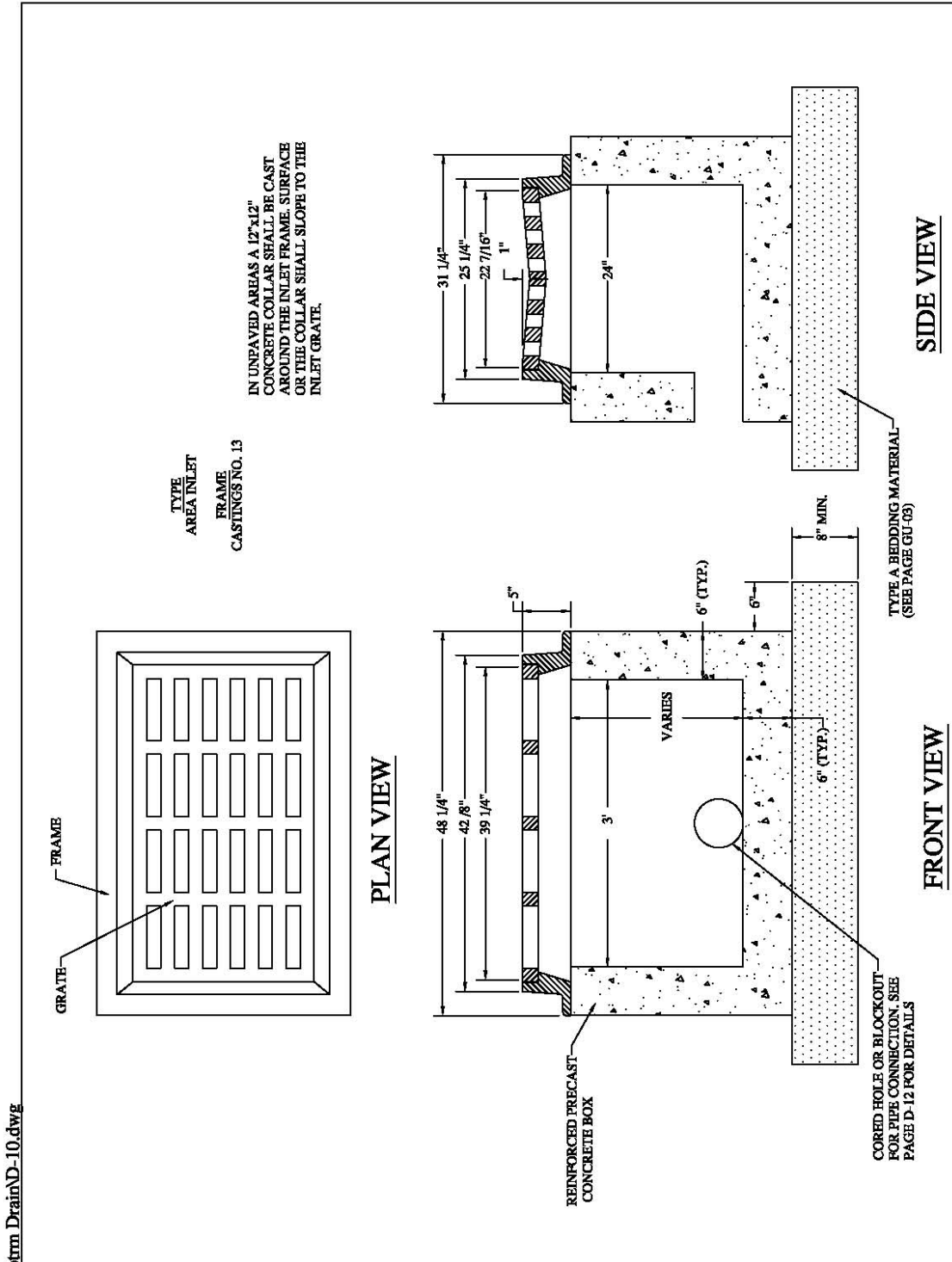




DOUBLE STORM DRAIN INLET WITH VERTICAL CURB OPENING				
<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION</p> <p>QUALITY OF LIFE IS OUR COMMITMENT</p>	<p>STANDARD STORM DRAIN DETAILS</p>	APPROVED: <u>YAR</u>	<p>PAGE D-08</p>
			REV: <u>JULY 2003</u>	
			DRAWN BY: <u>ELR</u>	



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IN UNPAVED AREAS A 12"x12"
CONCRETE COLLAR SHALL BE CAST
AROUND THE INLET FRAME SURFACE
OR THE COLLAR SHALL SLOPE TO THE
INLET GRATE.

TYPE
AREA INLET
FRAME
CASTINGS NO. 13

PLAN VIEW

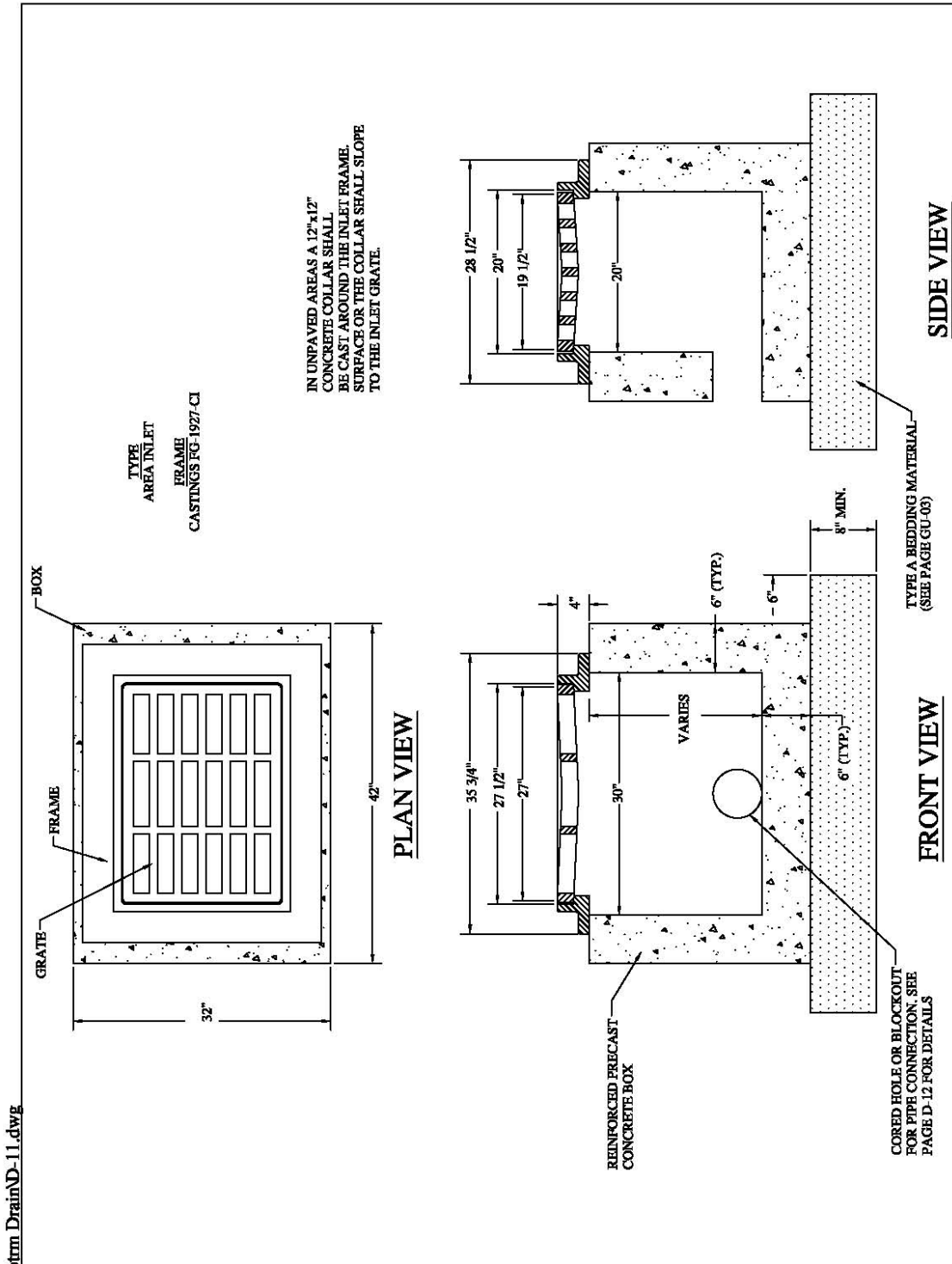
SIDE VIEW

FRONT VIEW

LARGE AREA INLET

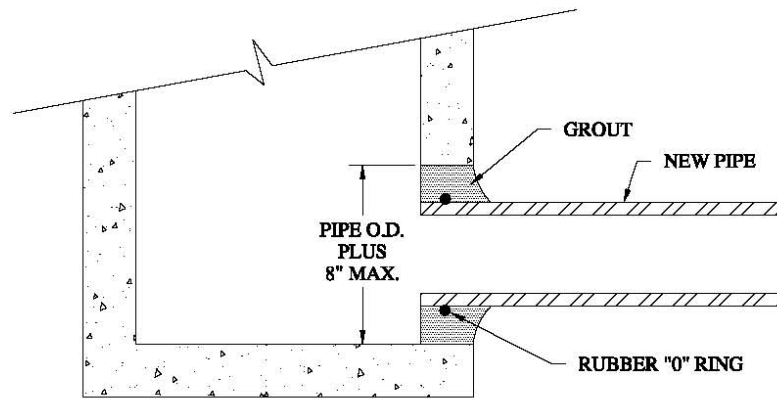
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<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>STANDARD STORM DRAIN DETAILS</p>	<p>APPROVED: <u>LAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>CLR</u></p>	<p>PAGE D-10</p>
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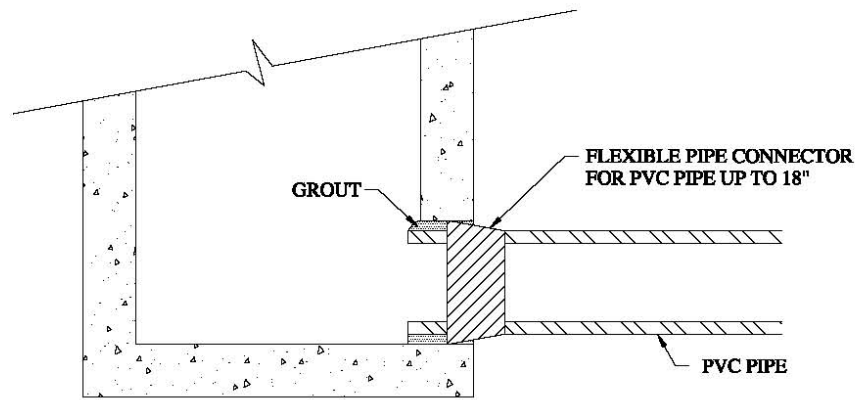
SMALL AREA INLET

<p>CITY OF MONTROSE</p>	<p>PUBLIC WORKS DEPARTMENT ENGINEERING DIVISION QUALITY OF LIFE IS OUR COMMITMENT</p>	<p>STANDARD STORM DRAIN DETAILS</p>	<p>APPROVED: <u>YAR</u> REV: <u>JULY 2003</u> DRAWN BY: <u>CLR</u></p>	<p>PAGE D-11</p>
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GRouted PIPE CONNECTION
(FOR ALL PIPE OTHER THAN PVC)

GRout FOR PIPE CONNECTIONS SHALL BE ALL-CRETE (5 OR 20 MINUTE SET) MANUFACTURED BY FOSROC INC. OR AN APPROVED SUBSTITUTE.



PVC PIPE CONNECTION

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CONNECTION TO EXISTING PIPE, MANHOLE OR INLET BOX



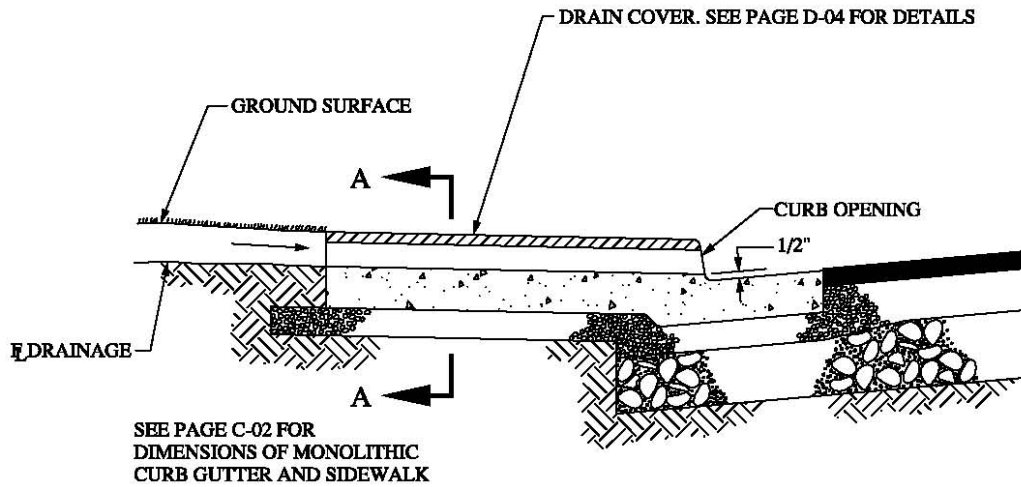
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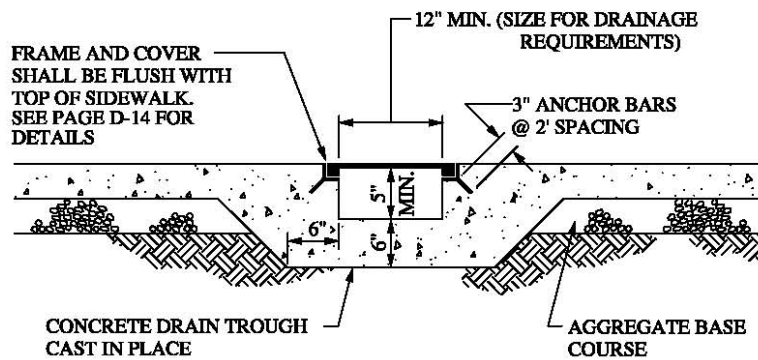
PAGE
D-12

NOTE: PREMANUFACTURED DRAIN TROUGHS MAY BE SUBSTITUTED FOR THIS DETAIL WHERE APPROVED BY THE CITY.



SEE PAGE C-02 FOR DIMENSIONS OF MONOLITHIC CURB GUTTER AND SIDEWALK

NOTE: FRAME AND COVER SHALL BE FABRICATED OF SAME MATERIAL (STEEL OR ALUMINUM). ALL STEEL SURFACES SHALL BE GALVANIZED PER AASHTO M-111.



SECTION A-A

DRAIN THROUGH FOR SIDEWALK CROSSING

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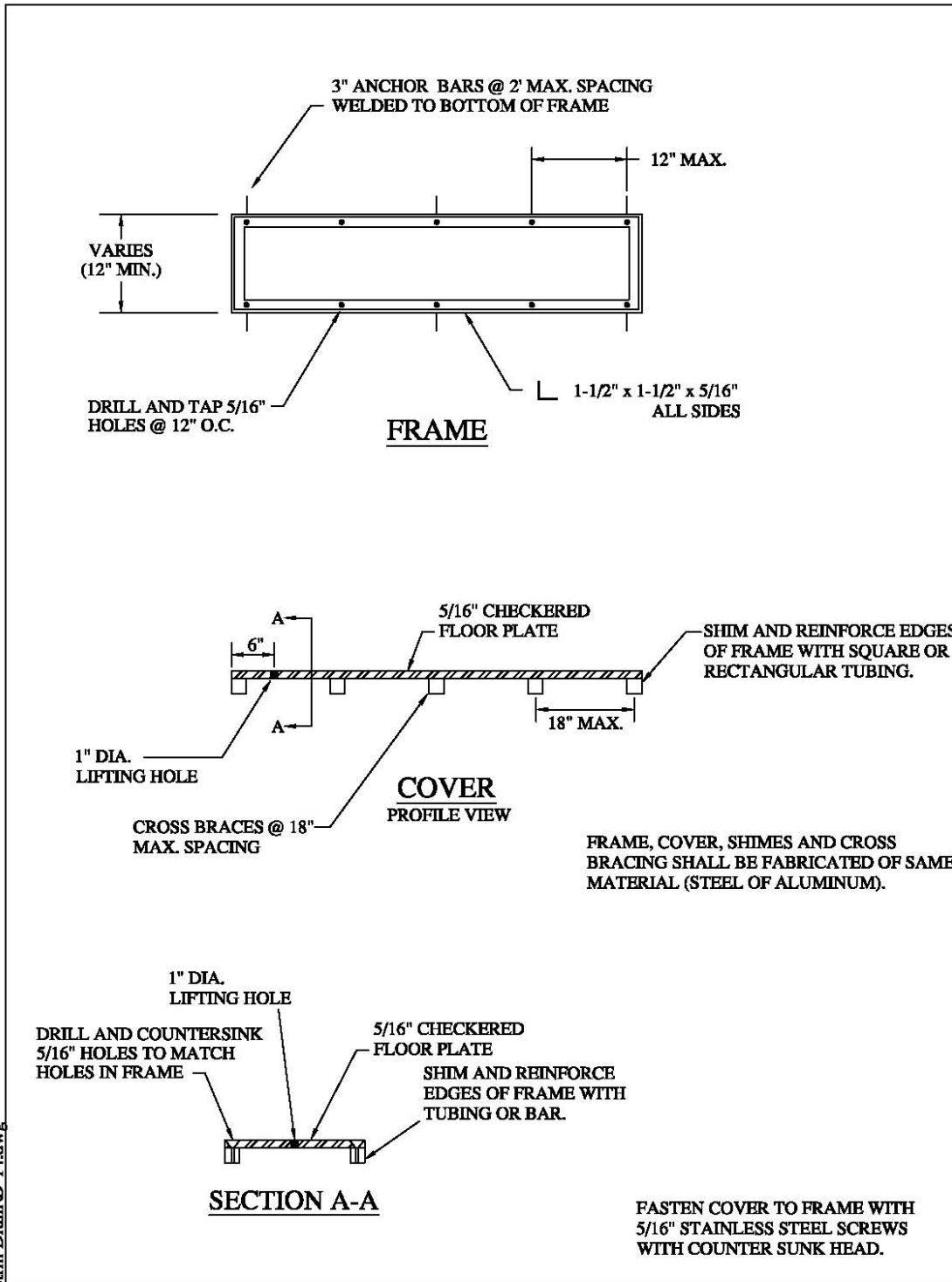


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FRAME AND COVER SIDEWALK DRAIN THROUGH




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9-6-8: STORM WATER MANAGEMENT DETAILS

SWMM-01	General Notes
SWMM-02	Performance Standards
SWMM-03	Maintenance
SWMM-04	Management Strategies
SWMM-05	Erosion and Sediment Control Measures
SWMM-06	Sediment Pond and Outlet Structure
SWMM-07	Overflow Spillway
SWMM-08	Block and Gravel Drop Inlet Filter
SWMM-09	Silt Fence Details
SWMM-10	Straw Bale Barrier Details
SWMM-11	Sedimentation Pond Calculations
SWMM-12	Curb Inlet Gravel Filter
SWMM-13	Surface Roughing Detail
SWMM-14	Construction Staging Pad
SWMM-15	Hay Bale Around Inlet
SWMM-16	Erosion Control Standard Notes
SWMM-17	Erosion Control Standard Notes Continued

GENERAL NOTES:




1. YOU MUST HAVE YOUR STORM WATER MANAGEMENT PLAN (SWMP) AND STORM WATER PERMIT AVAILABLE FOR REVIEW AT THE PRE-CONSTRUCTION MEETING. THE CITY WILL NOT ISSUE A "NOTICE TO PROCEED" WITH OUT VERIFICATION OF SAID ITEMS.
2. AT ALL TIMES DURING CONSTRUCTION, THE PERMITEE SHALL BE RESPONSIBLE FOR PREVENTING AND CONTROLLING EROSION DUE TO WIND AND RUNOFF. THE CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR MAINTAINING EROSION CONTROL FACILITIES SHOWN.
3. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED DUE TO UNFORSEEN PROBLEMS OR IF THE PLAN DOES NOT FUNCTION AS INTENDED. A REPRESENTATIVE OF THE CITY OF MONTROSE PUBLIC WORKS DEPARTMENT MAY REQUIRE ADDITIONAL CONTROL DEVICES UPON INSPECTION OF PROPOSED FACILITIES.
4. PERMITEE SHALL BE RESPONSIBLE FOR CLEANING DRAINAGE AND EROSION CONTROL FACILITIES AS REQUIRED. STREETS SHALL BE KEPT CLEAN OF DEBRIS FROM TRAFFIC FROM THIS SITE.
5. ALL AREAS DISTURBED DURING CONSTRUCTION SHALL BE PAVED, SEEDED WITH NATIVE VEGETATION, OR LANDSCAPED.
6. EROSION CONTROL STRUCTURES BELOW SODDED AREAS MAY BE REMOVED ONCE SOD AND FINAL LANDSCAPING IS IN PLACE. EROSION CONTROL STRUCTURES BELOW SEEDED AREAS MUST REMAIN IN PLACE UNTIL THE ENTIRE AREA HAS ESTABLISHED A MATURE COVERING OF HEALTHY VEGETATION. EROSION CONTROL IN PROPOSED PAVED AREAS SHALL REMAIN IN PLACE UNTIL PAVEMENT IS COMPLETE.
7. CONTRACTOR SHALL USE VEHICLE TRACKING CONTROL AT ALL LOCATIONS WHERE VEHICLES WILL ENTER OR EXIT THE SITE. CONTROL FACILITIES WILL BE MAINTAINED WHILE CONSTRUCTION IS IN PROGRESS, MOVED WHEN NECESSARY, AND REMOVED WHEN THE SITE IS PAVED.
8. SEEDING AND MULCHING WILL OCCUR WITHIN 14 DAYS OF THE COMPLETION OF OVERLOT GRADING OR WITHIN 14 DAYS ON AREAS THAT ARE TO BE LEFT IDLE FOR A PERIOD OF 60 DAYS OR MORE. SEVENTY PERCENT OF PRE EXISTING GROUND COVERAGE MUST BE RE-ESTABLISHED BEFORE WITHDRAWING THE PERMIT.

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<p>QUALITY OF LIFE IS OUR COMMITMENT!</p>	<p>SWMM-01</p>																												

PERFORMANCE STANDARDS:

THE GENERAL REQUIREMENTS FOR EROSION CONTROL WORK SHALL BE AS FOLLOWS:

1. ANY LAND DISTURBING ACTIVITY SHALL BE CONDUCTED IN SUCH A MANNER SO AS TO EFFECTIVELY REDUCE ACCELERATED SOIL EROSION AND RESULTING SEDIMENTATION.
2. STRUCTURAL EROSION CONTROL MEASURES INCLUDED IN THE APPROVED PLAN ARE TO BE INSTALLED PRIOR TO SOIL DISTURBANCE. INSTALLATION WILL MEET SPECIFICATIONS SHOWN ON THE DETAIL SHEET. CONTROL MEASURES NECESSARY FOR CONTINUING PHASES OF CONSTRUCTION SHALL BE INSTALLED AS DETAILED IN THE SUBMITTED CONSTRUCTION SCHEDULE OR AS NEEDED IN PROGRESSION TO THE FINAL EROSION CONTROL PLAN.
3. ALL LAND DISTURBING ACTIVITIES SHALL BE DESIGNED, CONSTRUCTED AND COMPLETED IN SUCH A MANNER THAT THE EXPOSURE TIME OF DISTURBED LAND SHALL BE LIMITED TO THE SHORTEST POSSIBLE PERIOD OF TIME.
4. SEDIMENT CAUSED BY ACCELERATED SOIL EROSION SHALL BE REMOVED FROM RUNOFF WATER BEFORE LEAVING THE SITE.
5. ANY TEMPORARY OR PERMANENT FACILITY DESIGNED AND CONSTRUCTED FOR THE CONVEYANCE OF WATER AROUND, THROUGH OR FROM THE LAND DISTURBING ACTIVITY SHALL BE DESIGNED TO LIMIT THE WATER FLOW TO A NON-EROSIVE VELOCITY.
6. TEMPORARY SOIL EROSION CONTROL FACILITIES SHALL BE REMOVED AND AREAS OF LAND DISTURBANCE GRADED AND STABILIZED WITH PERMANENT SOIL EROSION CONTROL MEASURES PURSUANT TO APPROVED PLANS AND SPECIFICATIONS.
7. THE PERMITEE IS RESPONSIBLE FOR MAINTENANCE OF ALL EROSION CONTROL STRUCTURES. THESE STRUCTURES ARE TO BE INSPECTED BY THE PERMITEE EVERY 10 DAYS AND AFTER EVERY PRECIPITATION EVENT TO INSURE THEIR EFFICIENCY AND TO EVALUATE MAINTENANCE NEEDS. MAINTENANCE OF THESE STRUCTURES MAY BE DIRECTED AT ANY TIME BY A CITY REPRESENTATIVE.

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MAINTENANCE:


IN GENERAL, ALL EROSION AND SEDIMENT CONTROL MEASURES WILL BE CHECKED WEEKLY AND AFTER EACH SIGNIFICANT RAINFALL. THE FOLLOWING ITEMS WILL BE CHECKED IN PARTICULAR:

1. THE CONSTRUCTION ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING AND FLOW OF MUD ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH STONE AS CONDITIONS DEMAND. ALL MATERIALS SPILLED, DROPPED, WASHED, OR TRACKED FROM VEHICLE OR SITE ONTO ROADWAY MUST BE REMOVED IMMEDIATELY.
2. THE BMP AND PERIMETER BARRIERS WILL BE CHECKED PERIODICALLY.

		CITY OF MONTROSE PUBLIC WORKS DEPARTMENT - ENGINEERING DIVISION
REVISION ▲ DESCRIPTION DATE _____ _____ REVISION ▲ _____ _____ REVISION ▲ _____ _____ REVISION ▲ _____ _____	DRAWN BY DATE _____ _____ DESIGNED BY DATE _____ _____ CHECKED BY DATE _____ _____ APPROVED BY DATE _____ _____	PROJECT NAME _____ FILE NO. _____
THE CITY OF MONTROSE QUALITY OF LIFE IS OUR COMMITMENT!		MAINTENANCE SDDETAILS\SWMM\SWMM-03 SWMM-03

MANAGEMENT STRATEGIES:

1. THE CONSTRUCTION ENTRANCE AND BARRIERS SHALL BE INSTALLED AS FIRST STEP IN THE GRADING PROCESS.
2. THE SILT FENCE SHOWN ON THE ENCLOSED EROSION CONTROL PLAN SHALL BE SECURED ACCORDING TO THE DETAILS CONTAINED ON THIS PLAN. THE SILT FENCE BARRIER WILL BE INSTALLED AS SHOWN ON THE EROSION CONTROL PLAN PRIOR TO OVERLOT GRADING.
3. THE PERMITEE SHALL HAVE OVERALL RESPONSIBILITY FOR PLAN IMPLEMENTATION. HE SHALL ALSO BE RESPONSIBLE FOR SEEING THAT APPROPRIATE CONSTRUCTION WORKERS AND SUBCONTRACTORS ARE AWARE OF THE PROVISIONS OF THE PLAN.
4. CLEAN-UP:
 - A. TRANSPORT TRASH AND DEBRIS, AND SURPLUS AND UNACCEPTABLE SOIL MATERIALS FROM PROJECT SITE AND DISPOSE OF BY LEGALLY APPROPRIATE METHODS.
 - B. REMOVE ALL TEMPORARY SHORING, BRACING, EROSION CONTROL, AND OTHER PROTECTION DEVICES WHEN NO LONGER REQUIRED BY THE CITY OF MONTROSE.

DESCRIPTION		DATE		 <p>THE CITY OF MONTROSE PUBLIC WORKS DEPARTMENT - ENGINEERING DIVISION PROJECT NAME <u>MANAGEMENT STRATEGIES</u> FILE NO. <u>SADETAILSNWMMNSWMM-04</u></p>
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REVISION Δ	_____	APPROVED BY	_____	<p>QUALITY OF LIFE IS OUR COMMITMENT!</p> <p>SWMM-04</p>

EROSION AND SEDIMENT CONTROL MEASURES:

UNLESS OTHERWISE INDICATED, ALL VEGETATIVE AND STRUCTURAL EROSION AND SEDIMENT CONTROL PRACTICES WILL BE CONSTRUCTED AND MAINTAINED ACCORDING TO MINIMUM STANDARDS AND SPECIFICATIONS OF THE CITY OF MONTROSE. THE CITY ENGINEER OR HIS DESIGNATED REPRESENTATIVE RESERVES THE OPTION TO REQUIRE ADDITIONAL SOIL EROSION CONTROL PROTECTION DUE TO UNFORSEEN CONDITIONS OR AS DETERMINED NECESSARY UPON FIELD INSPECTION. CHANGES PROPOSED BY THE CONTRACTOR MUST BE APPROVED BY THE CITY ENGINEER.

A. STRUCTURAL PRACTICES:


1. **TEMPORARY CONSTRUCTION ENTRANCE:**
A TEMPORARY CONSTRUCTION ENTRANCE SHALL BE INSTALLED AS THE INITIAL EROSION CONTROL MEASURE. CLEARING, GRUBBING AND OVERLOT GRADING MAY BEGIN ONLY AFTER THIS ENTRANCE IS IN PLACE. A 1-1/2 INCH CRUSHED GRAVEL STONE STABILIZED PAD SIX (6) INCHES THICK WILL BE INSTALLED AS SHOWN ON THE EROSION CONTROL PLAN. WHEELS MUST BE CLEANED TO REMOVE MUD PRIOR TO ENTRANCE ONTO PUBLIC RIGHTS-OF-WAY.
2. **SILT FENCE BARRIER:**
THE SILT FENCE SHOWN ON THE ENCLOSED EROSION CONTROL PLAN SHALL BE SECURED ACCORDING TO THE DETAILS CONTAINED ON THIS PLAN. THE SILT FENCE BARRIER WILL BE INSTALLED AS SHOWN ON THE EROSION CONTROL PLAN PRIOR TO OVERLOT GRADING.
3. **CONSTRUCTION SEDIMENTATION TRAP:**
THE EXISTING POND LOCATION WILL BE USED FOR A SEDIMENTATION TRAP DURING CONSTRUCTION. THE CONTRACTOR WILL BE REQUIRED TO MAINTAIN POND, REMOVING SEDIMENT AS NECESSARY.

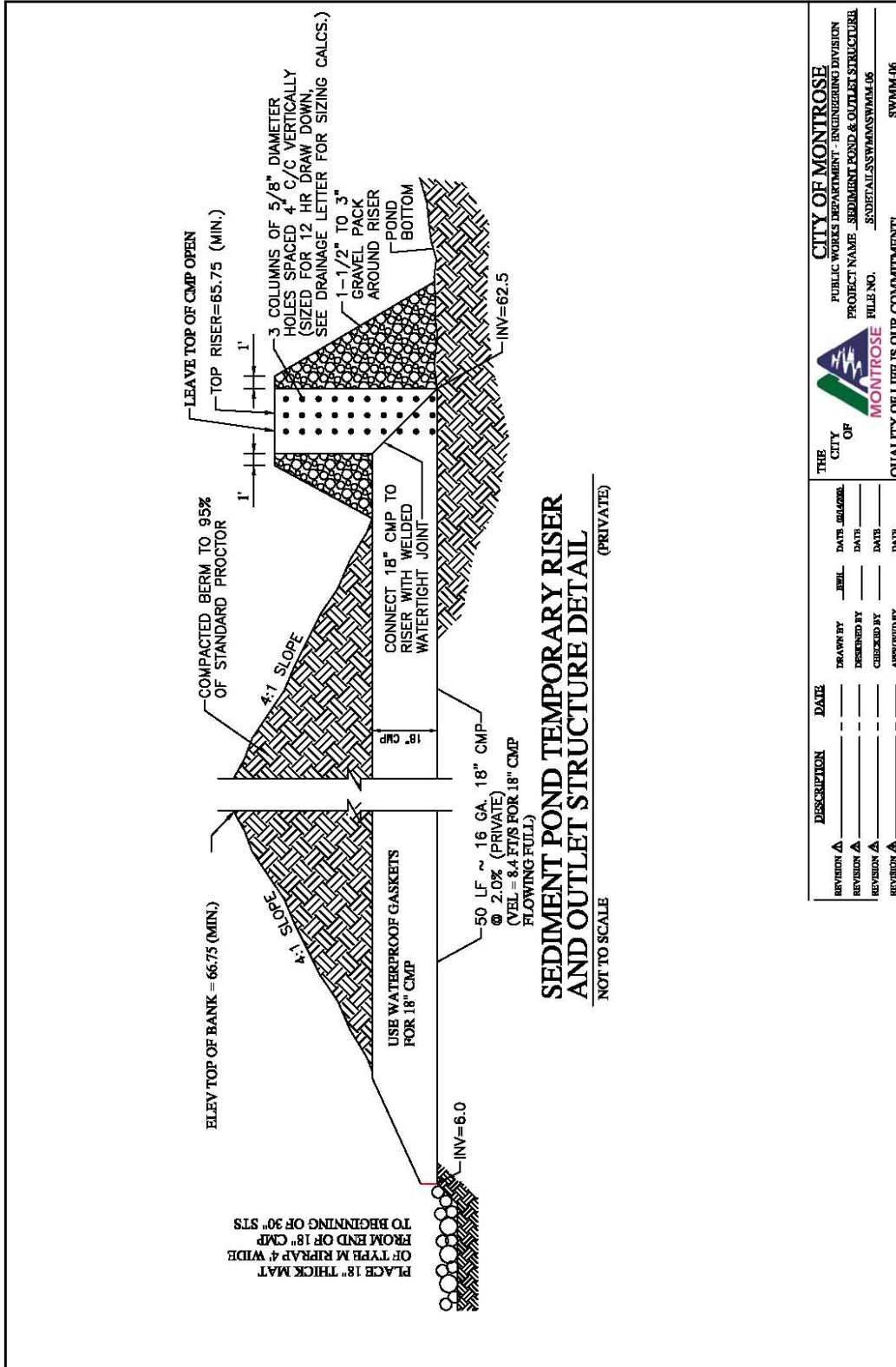
B. VEGETATIVE PRACTICES:

1. THE STRUCTURAL PRACTICES HAVE BEEN PLACED TO CONTROL EROSION SO THAT VEGETATIVE PRACTICES SHOULD NOT BE REQUIRED. SEEDING AND MULCHING WILL OCCUR WITHIN 14 DAYS OF THE COMPLETION OF OVERLOT GRADING OR WITHIN 14 DAYS ON AREAS THAT ARE TO BE LEFT IDLE FOR A PERIOD OF 60 DAYS OR MORE. SEVENTY PERCENT OF THE PRE EXISTING GROUND COVERAGE SHALL BE RE-ESTABLISHED

C. PERMANENT EROSION CONTROL:

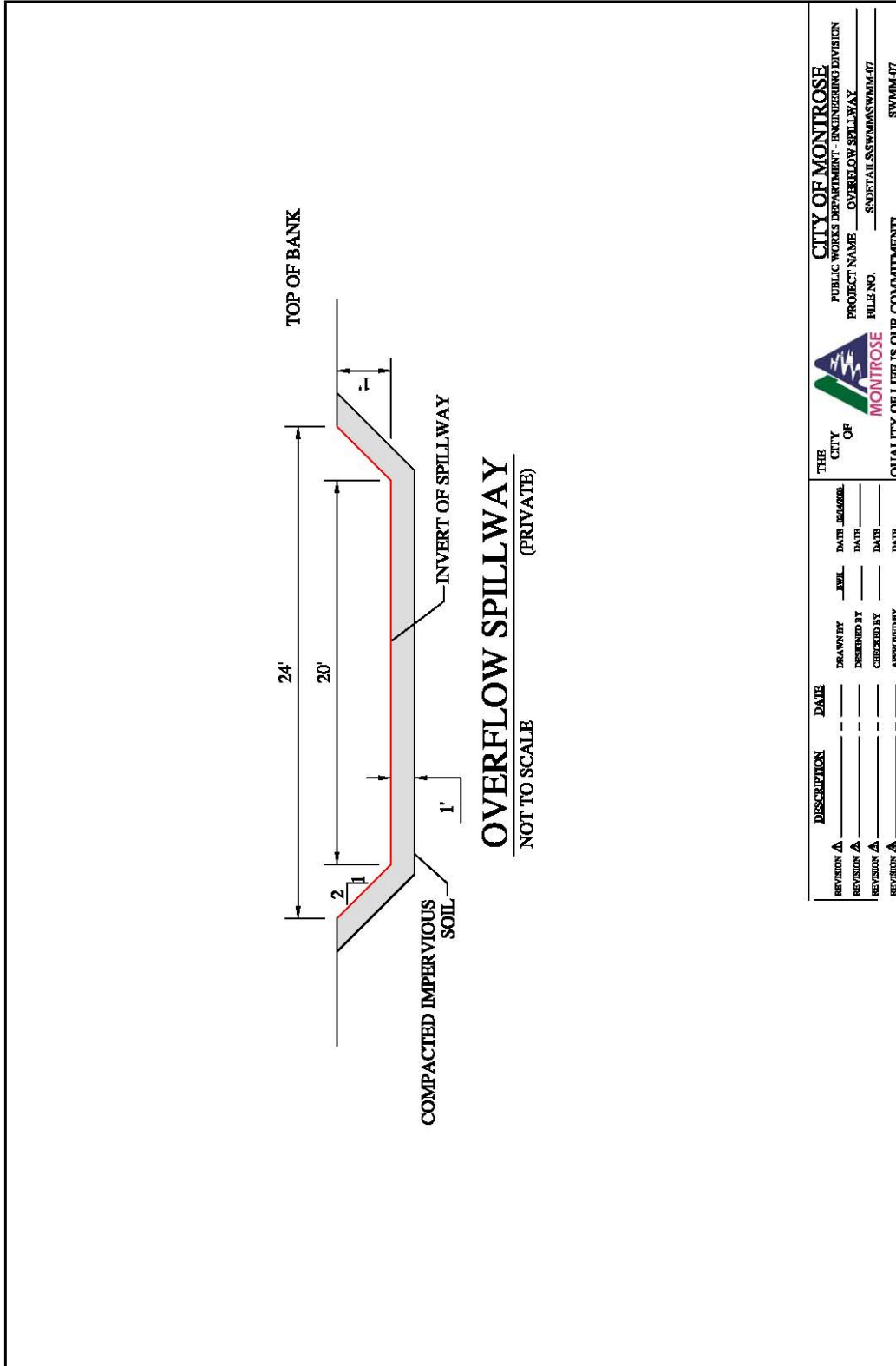
1. ALL GRADED AREAS WILL BE PERMANENTLY STABILIZED WITH VEGETATIVE COVER IN ACCORDANCE WITH THE CITY SPECIFICATIONS.

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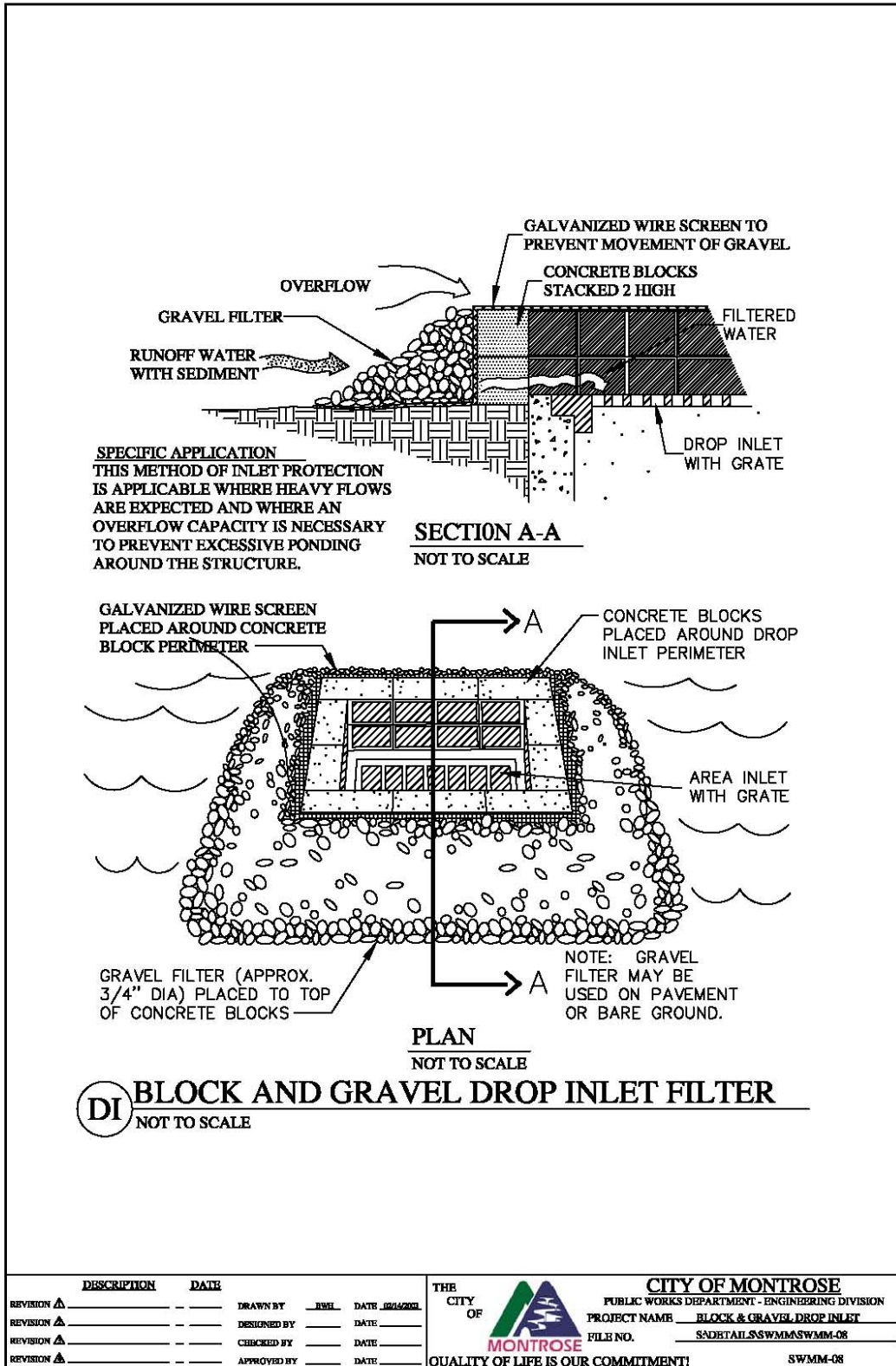
CITY OF MONTROSE
PUBLIC WORKS DEPARTMENT - ENGINEERING DIVISION
PROJECT NAME: SEDIMENT POND & OUTLET STRUCTURE
FILE NO.: SEDIMENTPOND/0406
SWMM 06

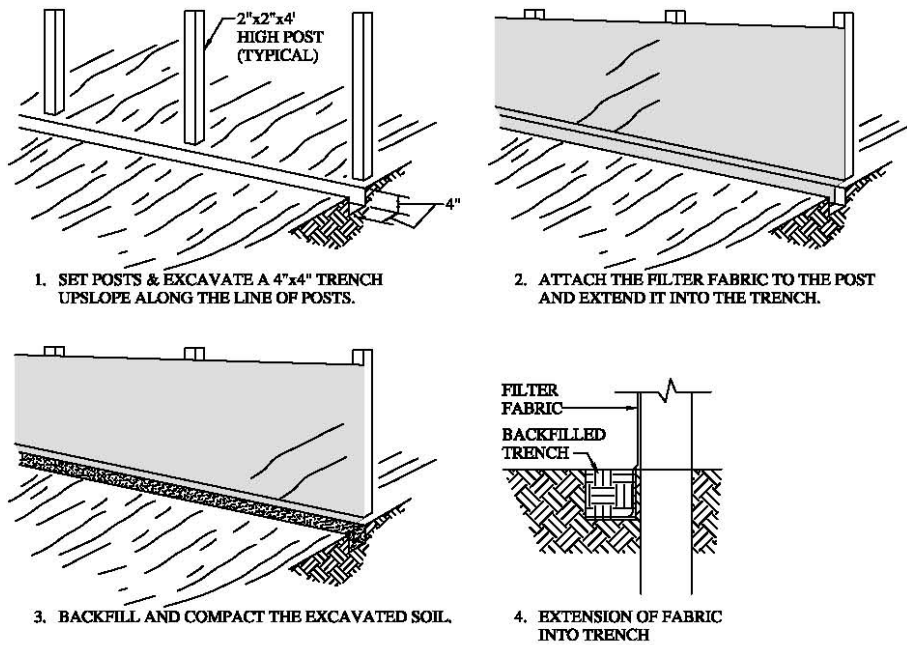


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PUBLIC WORKS DEPARTMENT - ENGINEERING DIVISION	PROJECT NAME <u>OVERFLOW SPILLWAY</u>
FILE NO. <u>SUBETALS/SWMM/SWMM-07</u>	SWMM 07

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SF SILT FENCE DETAILS
NOT TO SCALE

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THE CITY OF



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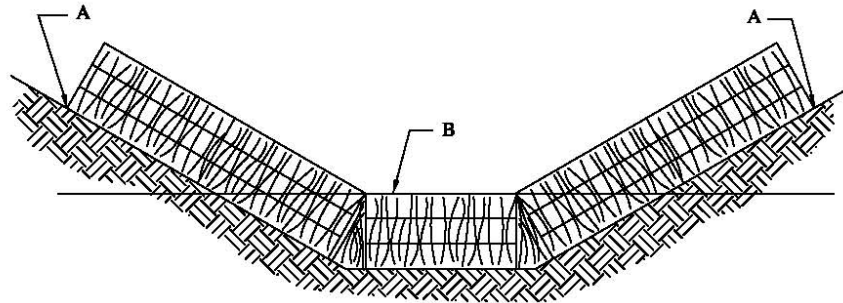
CITY OF MONTROSE

PUBLIC WORKS DEPARTMENT - ENGINEERING DIVISION

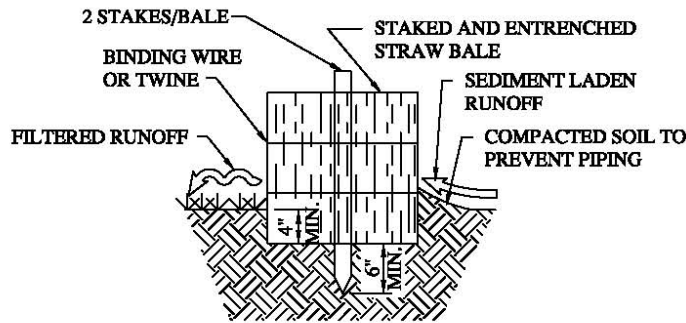
PROJECT NAME SILT FENCE DETAILS

FILE NO. S2DETAILS/SWMM/SWMM-09

SWMM-09



POINTS A SHOULD BE HIGHER THAN POINT B
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TYPICAL CROSS-SECTION

SB STRAW BALE BARRIER DETAILS
NOT TO SCALE

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PUBLIC WORKS DEPARTMENT - ENGINEERING DIVISION

PROJECT NAME STRAW BALE BARRIER DETAIL

FILE NO. SADETAILS/SWMM/SWMM-10


SWMM-10

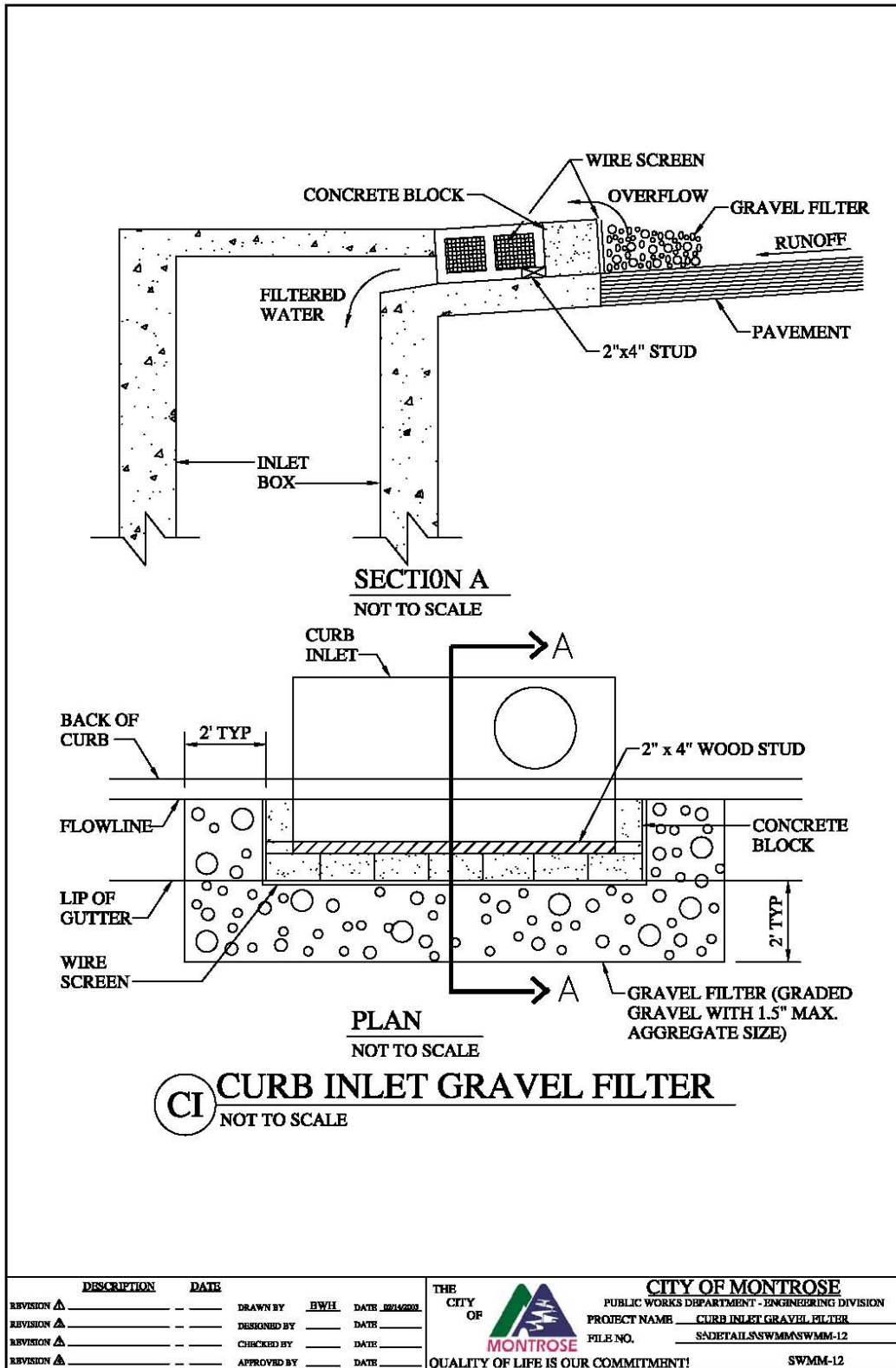
EXAMPLE SEDIMENTATION POND CALCULATIONS

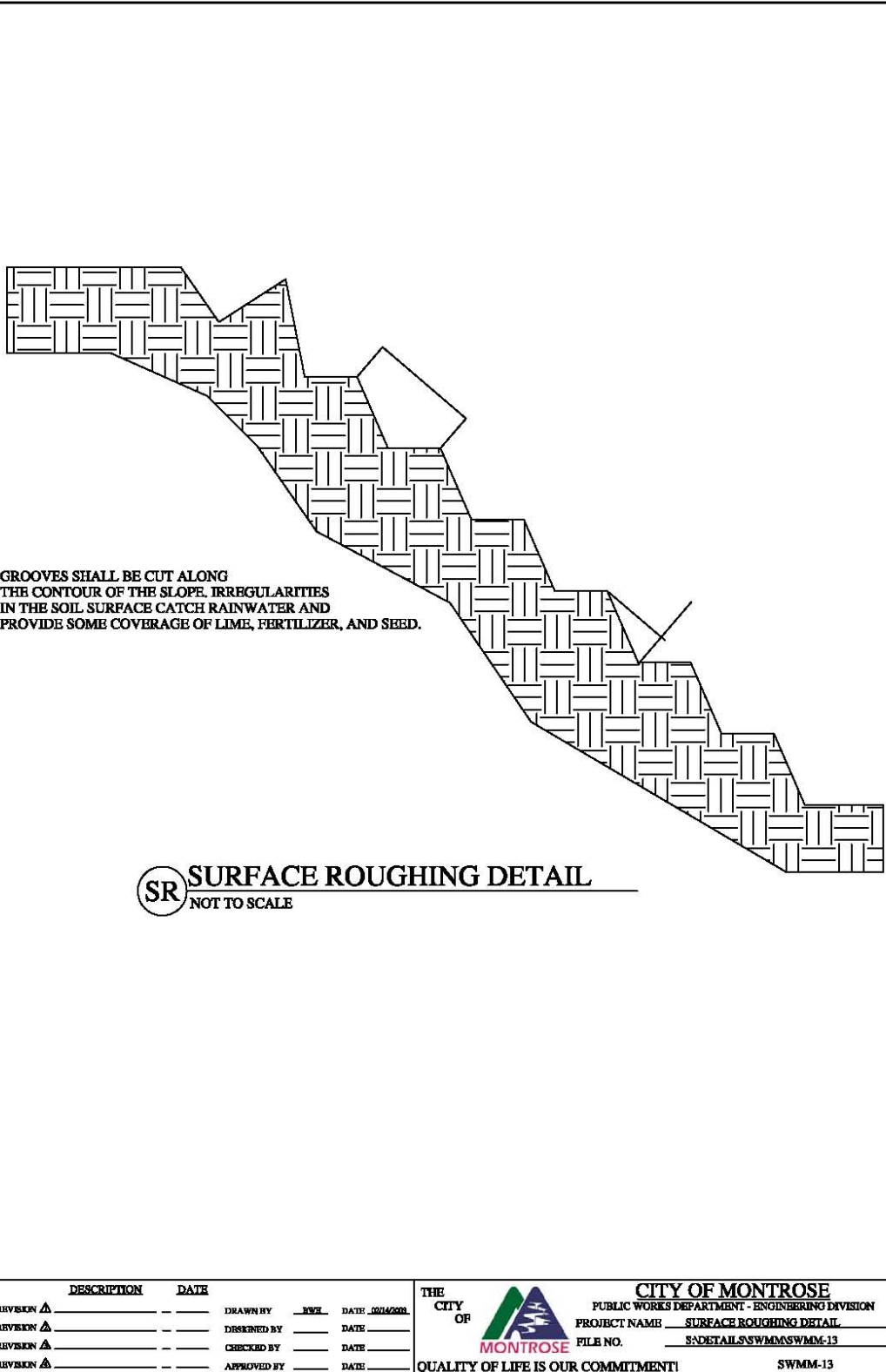
ELEV. (FT)	AREA (SF)	VOLUME (CF)	CUM. VOL. (CF)
62.5	0	0	0
63	2,531	632	632
64	11,277	6,904	7,536
65	13,662	12,469	20,005
66	16,024	14,843	34,848
67	18,434	17,229	52,077

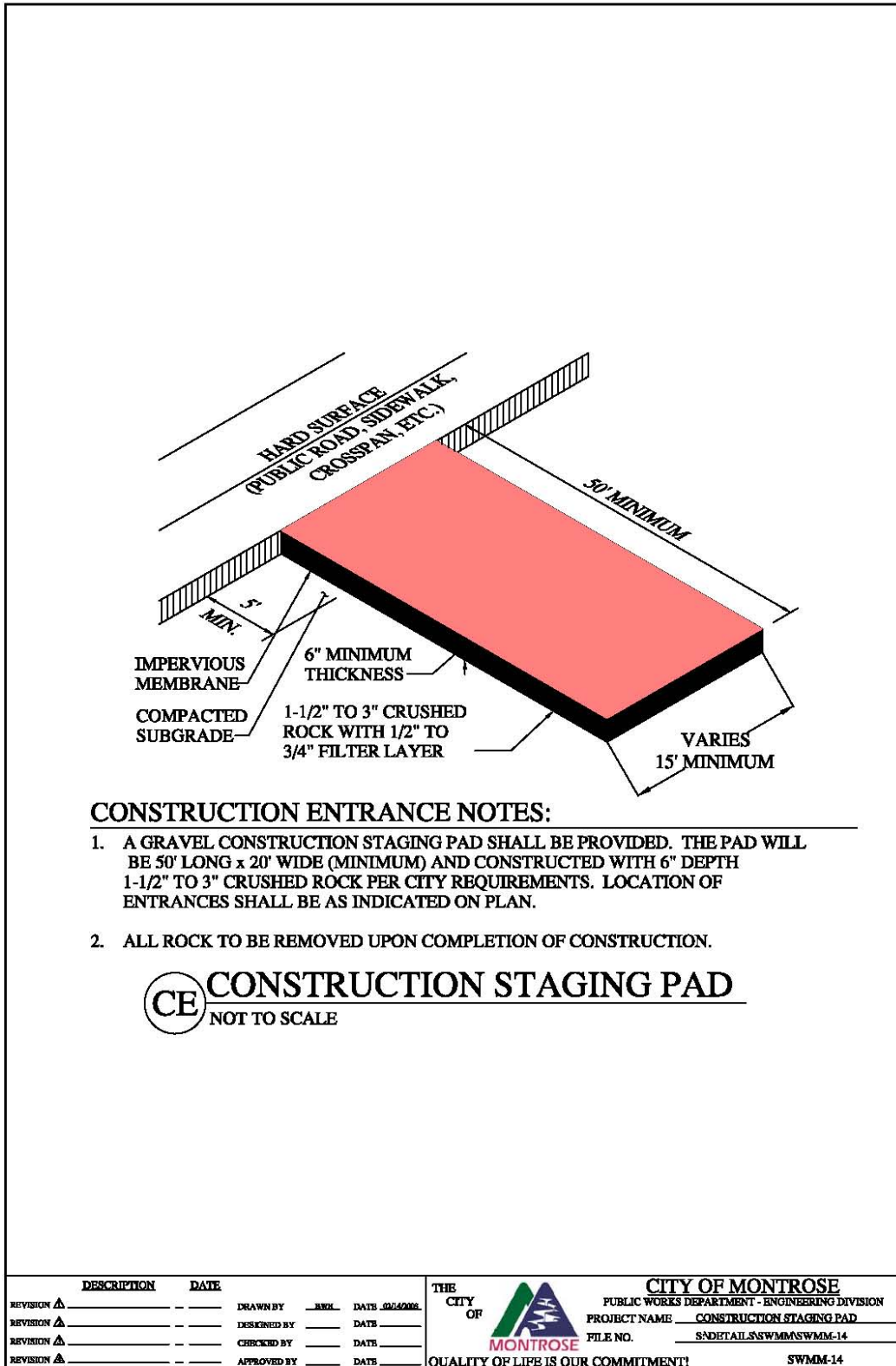
**REQUIRED: 900 CF/ACRE (SEDIMENTATION) - DISTURBED AREA ONLY
900 CF/ACRE (DETENTION) - ENTIRE SITE AREA**

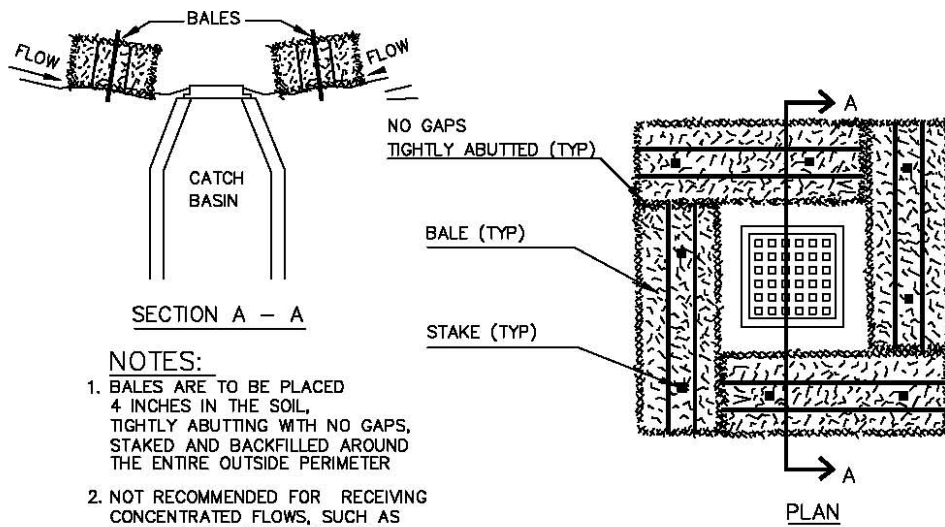
17.3 ACRES X 900 CF/ACRE = 15,570 CF STORAGE (SEDIMENTATION)
17.3 ACRES X 900 CF/ACRE = 15,570 CF STORAGE (DETENTION)
31,140 CF PONDING AT ELEVATION 65.75

DESCRIPTION	DATE	DRAWN BY _____	DATE _____	DESIGNED BY _____	DATE _____	 CITY OF MONTROSE PUBLIC WORKS DEPARTMENT - ENGINEERING DIVISION PROJECT NAME <u>SEDIMENTATION POND CALCULATIONS</u> FILE NO. <u>S\DETAILS\SWMM\SWMM-11</u>
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				APPROVED BY _____		DATE _____
QUALITY OF LIFE IS OUR COMMITMENT!						SWMM-11










NOTES:

1. BALES ARE TO BE PLACED 4 INCHES IN THE SOIL, TIGHTLY ABUTTING WITH NO GAPS, STAKED AND BACKFILLED AROUND THE ENTIRE OUTSIDE PERIMETER
2. NOT RECOMMENDED FOR RECEIVING CONCENTRATED FLOWS, SUCH AS STREETS OR HIGHWAY MEDIANS.

HB HAY BALES AROUND INLET DETAIL
NOT TO SCALE

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CITY OF MONTROSE

PUBLIC WORKS DEPARTMENT - ENGINEERING DIVISION

PROJECT NAME HAY BALES AROUND INLET

FILE NO. SADETAILS/SWMM/SWMM-15

SWMM-15

EROSION CONTROL STANDARD NOTES

1. THIS EROSION AND SEDIMENTATION CONTROL PLAN HAS BEEN PLACED IN THE CITY'S FILE FOR THIS PROJECT AND APPEARS TO FULFILL THE CITY OF MONTROSE EROSION CONTROL CRITERIA AND REQUIREMENTS. IT IS UNDERSTOOD THAT ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED OF THE PERMITEE DUE TO UNFORESEEN EROSION PROBLEMS OR IF THE SUBMITTED PLAN DOES NOT FUNCTION AS INTENDED. IF UNFORESEEN EROSION PROBLEMS DO OCCUR OR IF THE PLAN DOES NOT FUNCTION AS INTENDED, THE CITY INSPECTOR MAY REQUIRE MODIFICATIONS, ADDITIONS, OR REPAIRS AT THE TIME OF INSPECTION.
2. THESE REQUIREMENTS SHALL BE THE OBLIGATION OF THE PERMITEE, OWNER, SITE DEVELOPER, CONTRACTOR, AND/OR THEIR AUTHORIZED AGENTS, UNTIL SUCH TIME AS THE PLAN IS CERTIFIED AS PROPERLY COMPLETED, OR UNTIL SUCH TIME AS OTHERWISE ALLOWED BY THE CITY TO BE VOIDED, MODIFIED, OR REPLACED.
3. THIS PLAN SHALL BE KEPT ON SITE AT ALL TIMES.
4. ANY DISCREPANCY BETWEEN THIS PLAN AND AN APPROVED STORMWATER MANAGEMENT PLAN FOR THIS SITE SHALL REQUIRE COMPLIANCE WITH THE MORE RESTRICTIVE PLAN.
5. THE OWNER, SITE DEVELOPER, CONTRACTOR AND/OR THEIR AUTHORIZED AGENTS SHALL REMOVE ALL SEDIMENT, MUD, AND CONSTRUCTION DEBRIS THAT MAY ACCUMULATE IN THE FLOW LINES, PRIVATE PROPERTY, AND PUBLIC RIGHTS OF WAYS OF THE CITY AS A RESULT OF THIS CONSTRUCTION PROJECT. REMOVAL SHALL BE CONDUCTED WITHIN 48 HOURS.
6. THE OWNER, SITE DEVELOPER, CONTRACTOR AND/OR THEIR AUTHORIZED AGENTS SHALL PREVENT SEDIMENT, DEBRIS, AND ALL OTHER POLLUTANTS FROM ENTERING THE STORM SEWER SYSTEM DURING ALL DEMOLITION, EXCAVATION, TRENCHING, BORING, GRADING OR OTHER CONSTRUCTION OPERATIONS THAT ARE PART OF THIS PROJECT. THE OWNER, SITE DEVELOPER, CONTRACTOR, AND/OR THEIR AUTHORIZED AGENTS SHALL BE RESPONSIBLE FOR REMEDIATION OF ANY ADVERSE IMPACTS TO ADJACENT WATERWAYS, WETLANDS, OTHER PROPERTIES, ETC., RESULTING FROM WORK DONE AS PART OF THIS PROJECT.
7. ROUGH-CUT STREETS SHALL BE MULCHED OR SIMILARLY PROTECTED WITHIN THE 30-DAY PERIOD AFTER COMPLETION OF OVERLOT GRADING.
8. THE OWNER, SITE DEVELOPER, CONTRACTOR AND/OR THEIR AUTHORIZED AGENTS SHALL PREVENT LOSS OF CUT AND FILL MATERIAL BEING TRANSPORTED TO AND FROM THE SITE BY TAKING APPROPRIATE MEASURES. ALL MUD AND SEDIMENT TRACKED ONTO PUBLIC STREETS SHALL BE CLEANED IMMEDIATELY BY OWNER, SITE DEVELOPER, CONTRACTOR, AND/OR THEIR AUTHORIZED AGENTS. STREET CLEANING INCLUDES SHOVELING AND SWEEPING ACTIVITIES. AT NO TIME SHALL SEDIMENTS BE WASHED DOWN UNPROTECTED INLETS INTO THE CITY STORM SEWER SYSTEM.
9. SOILS THAT WILL BE STOCKPILED FOR MORE THAN 30 DAYS SHALL BE MULCHED AND SEEDED WITH A TEMPORARY OR PERMANENT GRASS COVER WITHIN 7 DAYS OF STOCKPILE CONSTRUCTION.
10. IF STOCKPILES ARE LOCATED WITHIN 100 FEET OF A DRAINAGEWAY, ADDITIONAL SEDIMENT CONTROLS SUCH AS TEMPORARY DIKES OR SILT FENCE SHALL BE REQUIRED.
11. TOPSOIL SHALL BE SALVAGED AND NOT REMOVED FROM THE SITE EXCEPT AS SET FORTH IN THE APPROVED PLANS. TOPSOIL AND OVERBURDEN SHALL BE SEGREGATED AND STOCKPILED SEPARATELY. SUITABLE OVERBURDEN AND THEN TOPSOIL SHALL BE REDISTRIBUTED WITHIN THE GRADED AREA AFTER ROUGH GRADING TO PROVIDE A SUITABLE BASE FOR AREAS WHICH WILL BE VEGETATED. RUNOFF FROM STOCKPILE AREAS SHALL BE CONTROLLED TO PREVENT SEDIMENT ENTERING RECEIVING WATERS.
12. FINAL OR TEMPORARY SOIL STABILIZATION MEASURES SHALL BE APPLIED: (1) TO DISTURBED AREAS AND STOCKPILES WITHIN 14 DAYS AFTER FINAL GRADE IS REACHED, (2) WITHIN 14 DAYS TO DISTURBED AREAS WHICH MAY NOT BE AT FINAL GRADE BUT WILL REMAIN DORMANT FOR LONGER THAN 30 DAYS, AND (3) WITHIN 14 DAYS OF STOCKPILE CONSTRUCTION ON ANY STOCKPILE WHICH WILL REMAIN DORMANT FOR LONGER THAN 30 DAYS.







FINAL SOIL STABILIZATION SHALL BE THE FINAL GROUND COVER DEFINED BY THE SITE PLAN OR ASSOCIATED DOCUMENTS. TEMPORARY SOIL STABILIZATION SHALL INCLUDE GRASSES FROM SEED AND MULCHING AS DESCRIBED BELOW: SEVENTY PERCENT OF PRE EXISTING GROUND COVERAGE MUST BE RE-ESTABLISHED.

THE SEEDBED SHALL BE WELL SETTLED AND FIRM, BUT FRIABLE ENOUGH THAT SEED CAN BE PLACED AT THE SEEDING DEPTH SPECIFIED. THE SEEDBED SHALL BE REASONABLY FREE OF WEEDS. SOILS THAT HAVE BEEN OVER-COMPACTED BY TRAFFIC OR EQUIPMENT, ESPECIALLY WHEN WET, SHALL BE TILLED TO BREAK-UP ROOTING RESTRICTIVE LAYERS AND THEN HARROWED, ROLLED OR PACKED TO PREPARE THE REQUIRED FIRM SEEDBED.

MULCH SHALL BE APPLIED AT A RATE OF 2 1/4 TONS PER ACRE AND SHALL BE ATTACHED BY AN APPROVED METHOD SUITABLE FOR THE TYPE OF MULCH USED. MULCH SHALL BE SPREAD UNIFORMLY, IN A CONTINUOUS BLANKET, AFTER SEEDING IS COMPLETE. MULCH SHALL BE CLEAN, WEED AND SEED FREE, LONG STEMMED GRASS OR HAY, LONG STEMMED STRAW OF OATS, WHEAT OR RYE. AT LEAST 50% OF MULCH, BY WEIGHT, SHALL BE 10 INCHES OR LONGER. MULCH SHALL BE SPREAD BY HAND OR BLOWER-TYPE MULCH SPREADER. MULCHING SHALL BE STARTED ON THE WINDWARD SIDE OF RELATIVELY FLAT AREAS OR ON THE UPPER PART OF A STEEP SLOPE AND CONTINUED UNIFORMLY UNTIL THE AREA IS COVERED. THE MULCH SHALL NOT BE BUNCHED. IMMEDIATELY FOLLOWING SPREADING, THE MULCH SHALL BE ANCHORED TO THE SOIL BY A V-TYPE WHEEL LAND PACKER OR A SCALLOPED-DICK LAND PACKER DESIGN TO FORCE MULCH INTO THE SOIL SURFACE A MINIMUM OF 3 INCHES. ALL SEEDED AREAS SHALL BE MULCHED AFTER SEEDING ON THE SAME DAY AS THE SEEDING.

THE SEED MIX AND RATE OF APPLICATION SHALL BE AS FOLLOWS (HYDRO SEEDING SHALL NOT BE USED):

SPECIES	VARIETY (PREFERRED)	PERCENT BY WEIGHT	POUNDS/ACRE OF PLS	
			BROADCAST	DRILLED
WESTERN WHEATGRASS	ARRIBA OR BARTON	42	13.2	6.6
SMOOTH BROME	LINCOLN	35	10.8	5.4
SIDE-OATS GRAMA	VAUGHN OR BUTTE	23	7.2	3.6
	TOTAL	100	31.2	15.6

<p>REVISION  _____ DESCRIPTION _____ DATE _____</p> <p>REVISION  _____ DRAWN BY _____ DATE _____</p> <p>REVISION  _____ DESIGNED BY _____ DATE _____</p> <p>REVISION  _____ CHECKED BY _____ DATE _____</p> <p>REVISION  _____ APPROVED BY _____ DATE _____</p>		 <p>CITY OF MONTROSE PUBLIC WORKS DEPARTMENT - ENGINEERING DIVISION PROJECT NAME: <u>EROSION CONTROL STANDARD NOTES</u> FILE NO. <u>S\DETAILS\SWMM\SWMM-16</u></p> <p>QUALITY OF LIFE IS OUR COMMITMENT!</p>	
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